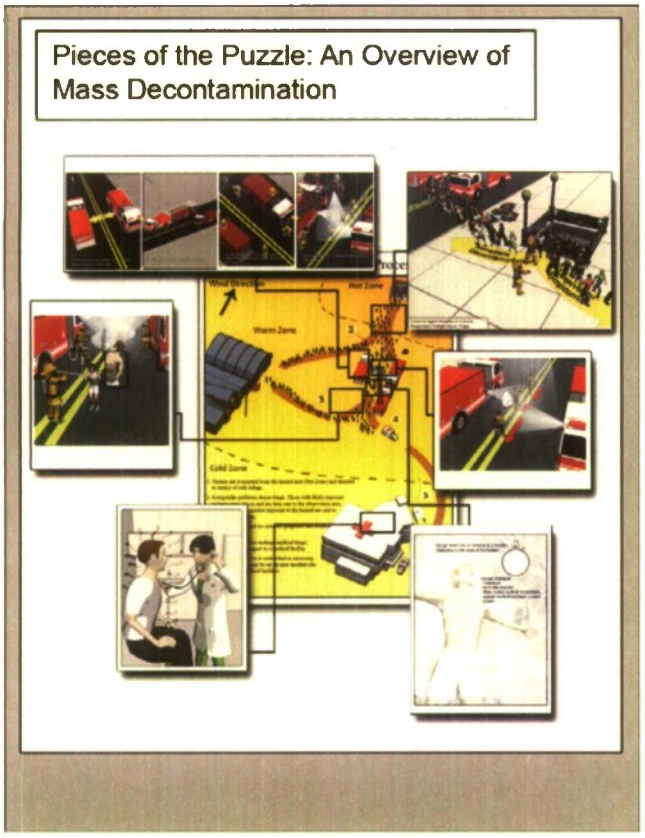

The key to successful mass decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people.

U.S. ARMY EDGEWOOD CHEMICAL BIOLOGICAL CENTER SPECIAL REPORT

ECBC-SP-024

Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident

Volumes I and II

Prepared by:

U.S. Army Chemical, Biological, Radiological and Nuclear School
Fort Leonard Wood, MO 65473-8926

U.S. Army Edgewood Chemical Biological Center
Aberdeen Proving Ground, MD 21010-5424

April 2009

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorizing documents.

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The U.S. Army Edgewood Chemical Biological Center (ECBC) published two reports on mass casualty decontamination after a terrorist chemical attack as part of the Nunn Lugar Domenici Domestic Preparedness Program. At the time of this study, the "Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident" and "Guidelines for Cold Weather Mass Decontamination" were about 8 years old. The U.S. Army Chemical Biological, Radiological and Nuclear School required an updated version of these reports for their development of decontamination doctrine. The School tasked ECBC to update the original reports. Accordingly, ECBC formed and led a team to update the original reports. This focus of this study is all hazards (chemical, biological, radiological, unknown) decontamination and was compiled with input from community responders, Army responders, DoD medial, and DoD chemical-biological technical expertise. The decontamination study will serve as the basis for Army doctrine, but it's written to be applicable to DoD and civilian response organizations as well.

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PREFACE

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These updated Guidelines could not have been completed without the significant collaborative efforts of the Mass Decontamination Working Group. Members of the Working Group include:

- Aberdeen Proving Ground Fire and Emergency Services, Aberdeen, Maryland
- Armed Forces Radiobiology Research Institute
- Baltimore County Fire Department, Baltimore County, Maryland
- Booz Allen Hamilton
- District of Columbia Fire and Emergency Medical Services, Washington, DC
- District of Columbia Homeland Security and Emergency Management Agency, Washington, DC
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- U.S. Army Edgewood Chemical Biological Center
- U.S. Army Medical Research Institute of Chemical Defense
- U.S. Army Medical Research Institute of Infectious Diseases
- U.S. Army Training and Doctrine Command
- Washington Hospital Center, Washington, DC

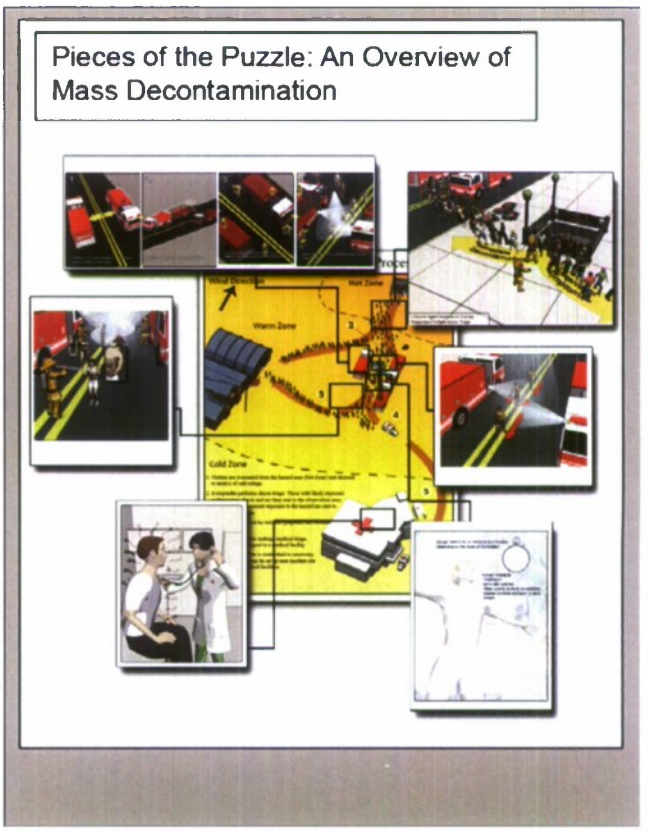
Principles of Mass Decontamination

- ***Removing clothes is the single most critical step in mass decontamination and may remove 80-90% of physical contamination.***
- ***Do not delay removal of clothes or application of a high-volume, low pressure water shower to set up tents, additional equipment or to create a soap-water solution.***
- Conduct decontamination triage prior to administering a high-volume, low-pressure water shower (~60 psi).
- Wash time should be between 30 seconds and three minutes, depending on the situation.
- When the contamination **involves chemical vapors, biological or radiological material**, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of the contamination.
- Rubbing should start with the head and proceed down the body to the feet.
- Victim observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
- Perform secondary decontamination as necessary.

The key to successful mass decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people.

Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident

Volume I of II



Prepared by:

U.S. Army Chemical Biological, Radiological and Nuclear School and U.S. Army Edgewood Chemical Biological Center

April 2009

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GUIDELINES FOR MASS CASUALTY DECONTAMINATION DURING A HAZMAT/WEAPON OF MASS DESTRUCTRION TERRORIST INCIDENT VOLUME I OF II

1.0 Introduction

In the recent past, terrorist organizations have used different chemical, biological, and radiological (CBR) weapons to pursue their own agendas. In 1995, the Aum Shinrikyo cult released sarin onto the Tokyo subway system, killing 12 and injuring hundreds. In 2001, anthrax spores were sent through the U.S. Postal Service killing five postal employees and infecting 22 others. The increasing complexity and scale of these incidents suggest the possibility of a large scale attack with a Weapon of Mass Destruction (WMD) causing thousands of casualties on US soil. Since these attacks are difficult to prevent and may happen anywhere and at any time, mass decontamination is one of the key elements to managing the consequences of such an event, saving lives, and limiting the number of injuries.

2.0 Background

These Guidelines are an update of the United States Army Soldier and Biological Chemical Command (SBCCOM) - now the United States Army Edgewood Chemical Biological Center (ECBC) - January 2000 *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident* and January 2002 *Guidelines for Cold Weather Mass Decontamination During a Terrorist Chemical Agent Incident*. These Guidelines supersede these original 2000 and 2002 Guidelines and are expanded to include all chemical, biological and radiological hazards. These Guidelines represent the latest evolution in our approach to mass casualty decontamination.

3.0 Objective

These Guidelines were developed for first responders to provide information and suggested procedures for mass casualty decontamination following a hazardous material (HAZMAT)/WMD attack.

There is no perfect solution to mass casualty decontamination and no single process or method can account for all variables (e.g., hazard, time, number of victims, environmental conditions, resources). These updated Guidelines are intended to identify a simple, consistent mass decontamination process that could be applied with reasonable effectiveness to any HAZMAT/WMD incident. In other words, *use the fastest approach that will cause the least harm and do the most good for the majority of the people.*

4.0 Scope

These Guidelines are based on exposure to all hazards and focus on civilian mass casualty decontamination. These Guidelines primarily focus on chemical, biological, and radiological (CBR) agents, but also include Toxic Industrial Chemicals (TICs), Toxic Industrial Materials (TIMs), and toxins (collectively referred to in this document as HAZMAT/WMD). These

Guidelines do not cover each type of threat individually, however, the basic principles outlined are applicable to all HAZMAT/WMD situations.

This document addresses decontamination of an overwhelming number of victims resulting from a HAZMAT/WMD incident in a population center. Mass casualty decontamination requires a slightly different approach than the individual technical and equipment decontamination applied during typical HAZMAT incidents.

These Guidelines are designed for use during the first minutes of a mass casualty HAZMAT/WMD incident to reduce contamination and minimize casualties.

5.0 Guidelines Format

These Guidelines are divided into two volumes:

5.1 Volume I

Volume I is a quick reference book and designed to be a short, concise description of procedures to set up and execute mass decontamination. Volume I is designed to be separated and distributed to team members for use during a mass casualty HAZMAT/WMD incident.

5.2 Volume II

Volume II is a more in-depth compendium of HAZMAT/WMD mass casualty decontamination. It contains the reasoning behind the recommended procedures in Volume I, a review of the Guidelines development process, reference sources, potential best practices, additional considerations, and information concerning the working group that developed these Guidelines.

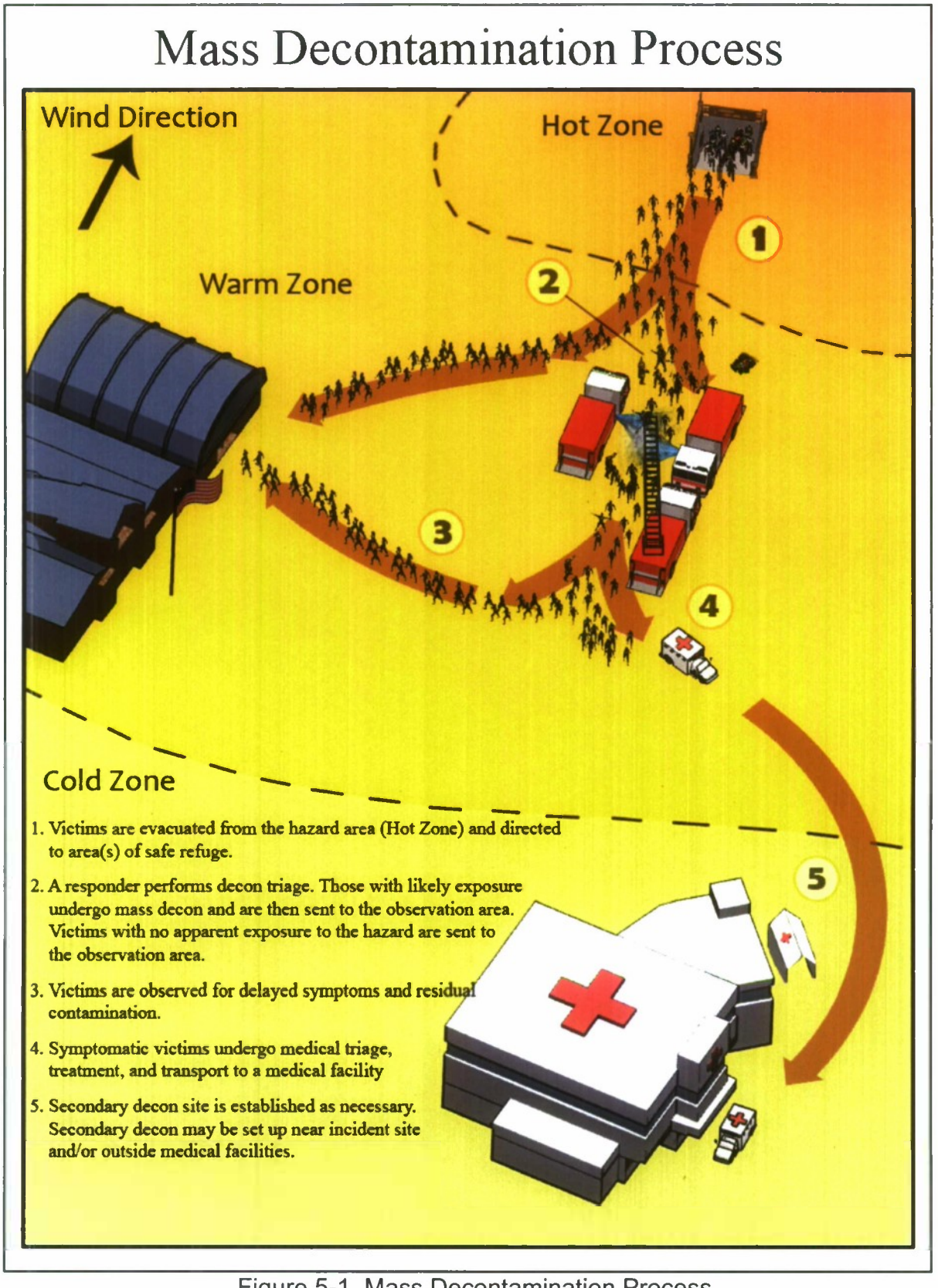


Figure 5-1. Mass Decontamination Process

6.0 Overview

This section discusses the basic foundation and a recommended procedure for mass casualty decontamination. As the graphic on the preceding page (Figure 5.1) demonstrates, mass decontamination is a multi-stage, resource intensive process. The approach presented in these Guidelines represents a standard method of HAZMAT/WMD mass casualty decontamination. The concepts in this section can be implemented quickly by a wide range of first responder organizations and represent the least resource intensive, and most practical and efficient method of mass decontamination.

Principals of Mass Decontamination

- Removing clothes is the single most critical step and may remove 80-90% of physical contamination.
- Do not delay removal of clothes or application of high-volume, low-pressure water shower to set up tents, additional equipment or to create a soap-water solution.
- Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
- Wash time should be between 30 seconds and three minutes, depending on the situation.
- When the contamination involves chemical vapors, biological or radiological material, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of contamination.
- Rubbing should start with the head and proceed down the body to the feet.
- Victim observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
- Perform secondary decontamination as necessary.

6.1 Definition of Decontamination

Decontamination refers to means that reduce the hazard of a contaminant. There are two basic methods of decontamination, physical removal and neutralization. Physical removal involves mechanical action with techniques such as gentle friction with a soft cloth or sponge, blotting, and washing. Neutralization involves methods and/or materials to counteract the harmful effects of the contaminant.

The focus of mass casualty decontamination is only on physical removal of the contaminant. The addition of neutralizing agents is likely to cause delay in the execution of mass decontamination, as well as create potential additional hazards and safety issues when decontaminating large numbers of personnel not familiar with the decontamination process. Equipment such as decontamination tents and the use of additives such as soap are best implemented at the secondary decontamination site. If physical assets are limited, one possible method of secondary decontamination is re-running victims through the initial decontamination site, but at a slower and more deliberate pace that emphasizes thorough cleaning and removal of all residual agent. Liquid soap, if available, should be distributed for victims' use during this secondary decontamination.

6.2 Purposes of Decontamination

The three most important reasons for decontaminating exposed victims are:

- Removing the agent from the victim's skin and clothing, thus reducing further agent exposure and physical effects.

- Protecting emergency responders, medical personnel and others from secondary transfer exposures.
- Preventing victims from spreading contamination over additional areas.

7.0 Mass Casualty Decontamination Operation

These Guidelines identify five basic steps for the process of mass decontamination:

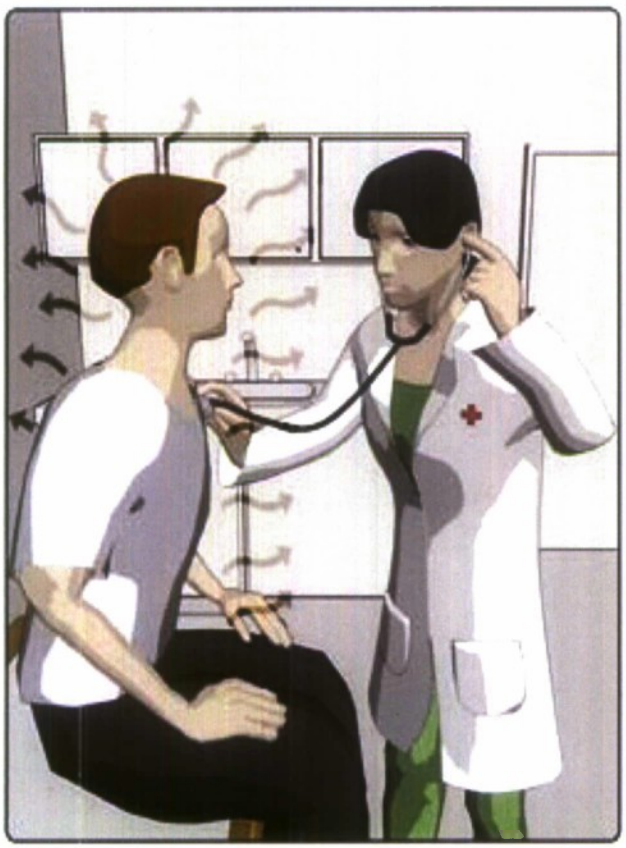


Figure 6-1. Off-Gassing Hazard

1. Initial Size-up
2. Victim Control and Decontamination Triage
3. Decontamination Setup
4. Mass Decontamination Execution
5. Post Decontamination

These five steps are described briefly below and are described in more detail in Volume II. Appendix A of this volume contains individual checklists for each step. These checklists are designed to be removed and used as quick reference guides during an actual response and mass casualty decontamination. The reverse sides of some of the checklists contain visual graphics designed to support that particular step.

Decontamination must be conducted as soon as possible to be effective in saving lives, limiting injuries and reducing the spread of contamination. Responders should use resources that are immediately available and start decontamination as soon as possible.

7.1 Step 1: Initial Size-up

This step is performed in accordance with standard guidelines for first responders when arriving at an incident scene. When HAZMAT/WMD exposure is suspected, first responders perform a safety assessment and attempt to identify signs/symptoms of exposure to determine whether mass decontamination is necessary.

7.2 Step 2: Victim Control and Decontamination Triage

This step involves gaining initial control of the victims and directing them to area(s) of safe refuge so responders can provide guidance and instruction. Decontamination triage involves separating victims into prioritized groups for decontamination. Rapidly identifying victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination. The Victim Control/Decontamination Triage checklist included in

Appendix A provides recommended priorities for victim decontamination. A Decontamination Triage Decision Tree is included on the back of the checklist.

Figure 7-1. Step 2: Decontamination Triage

7.3 Step 3: Decontamination Setup

This step includes establishing incident scene zones and setting up the actual decontamination site and operation. Section 8.2 of this volume includes instructions and graphics describing set up of a simple Ladder Pipe Decontamination System (LDS). The checklist for step 3 (see Appendix A) also includes these instructions, as well as a graphic representation of the LDS on the reverse side of the checklist.

7.4 Step 4: Mass Decontamination Conduct

Step 4 addresses procedures for performing decontamination on a large number of victims, including victim instructions for properly removing clothing and proceeding through a decontamination shower corridor. Conduct also covers identification of victims who have been decontaminated and directing them to an area(s) of safe refuge for observation where they can be monitored for delayed symptoms or the need for secondary decontamination. Secondary

decontamination with an emulsifier such as soap may be necessary if an oily liquid hazard (e.g., sulfur mustard) is involved and initial decontamination is performed with water only. Though the use of a soap-water solution is best for physical removal of all hazards, it will likely be required for oily liquid agents in order to provide the most effective physical removal of the agent from the victims' skin.

***Only if responders are capable of immediately applying a soap and water solution* does this method represent the better solution for all HAZMAT/WMD mass casualty decontamination situations.**

Figure 7-2. Oily, Liquid Residue Requiring Secondary Decontamination

7.5 Step 5: Post Decontamination

Step 5 describes actions to be taken following completion of initial mass decontamination, including observing victims for delayed symptoms and evidence of residual contamination; performing secondary decontamination as necessary; arranging for clothing/cover for decontaminated victims; recovering personal items (if possible); and transporting victims to medical facilities for follow-on care.

8.0 Basic All-Hazards Mass Decontamination Approach

8.1 Clothing Removal

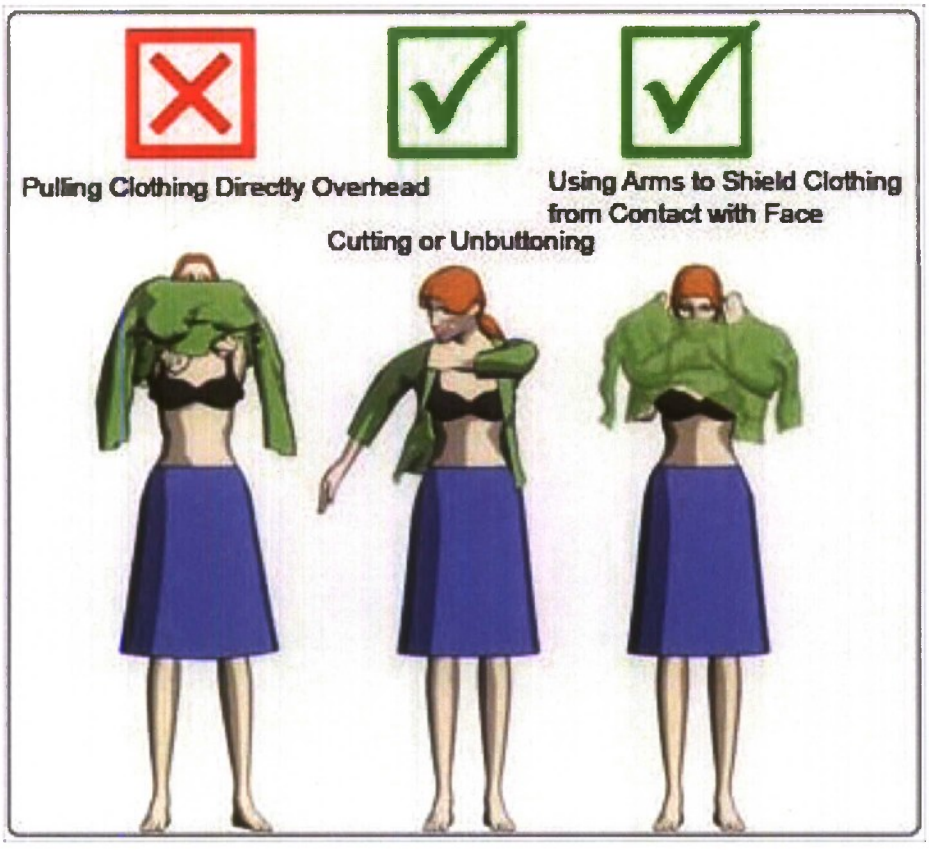


Figure 8-1. Proper Removal of Clothing

Having a victim remove their clothes will greatly reduce risk in all cases. Victims should be encouraged to immediately remove as much clothing as possible – the more clothing removed the better. At a minimum, victims should remove outer garments down to their underwear.

Whenever possible, victims should unbutton or cut clothes to remove them rather than lift them over their head (Figure 8-1). This will reduce the chance of exposing the head, face and eyes to contamination. If clothes must be lifted over the head, instruct victims to do so carefully by placing their hands and arms on the inside of the garment and using their hands to pull the clothing away from the face and head as much as possible when removing it.

Removal of outer garments may remove 80-90% of physical contamination.

8.2 Water Shower

The most expedient approach following removal of clothing is to use readily available equipment to provide an emergency high-volume, low-pressure (approximately 60 pounds per square inch (psi)) water shower for up to three minutes. While longer and more thorough washing increases the effectiveness of decontamination, depending on the number of victims and resources available, three minutes may not be practical. First responders should adjust the shower time to as little as 30 seconds to enable victims to receive an initial decontamination water shower as rapidly as possible.

Note: Time is critical. DO NOT DELAY initial decontamination to set up decontamination tents, shelter tents, or to add soap.

While victims are waiting to be decontaminated, keep adequate spacing between individuals to avoid secondary contamination and exposure to off-gassing.

When moving through the decontamination shower, victims should tilt their heads back, raise their arms and spread their legs to expose the armpit and groin areas and prevent runoff from the head/hair getting into the eyes, nose or mouth (Figure 8-2). Victims should occasionally turn 90 degrees (1/4 turn) to expose their entire bodies to the water cross stream (Figure 8-3).

When the contamination does not involve oily, liquid chemical agent, using gentle friction, such as rubbing with hands, a soft cloth, or sponges is recommended to aid in removal of the contamination. This process must start with the head and proceed down the body to the feet.

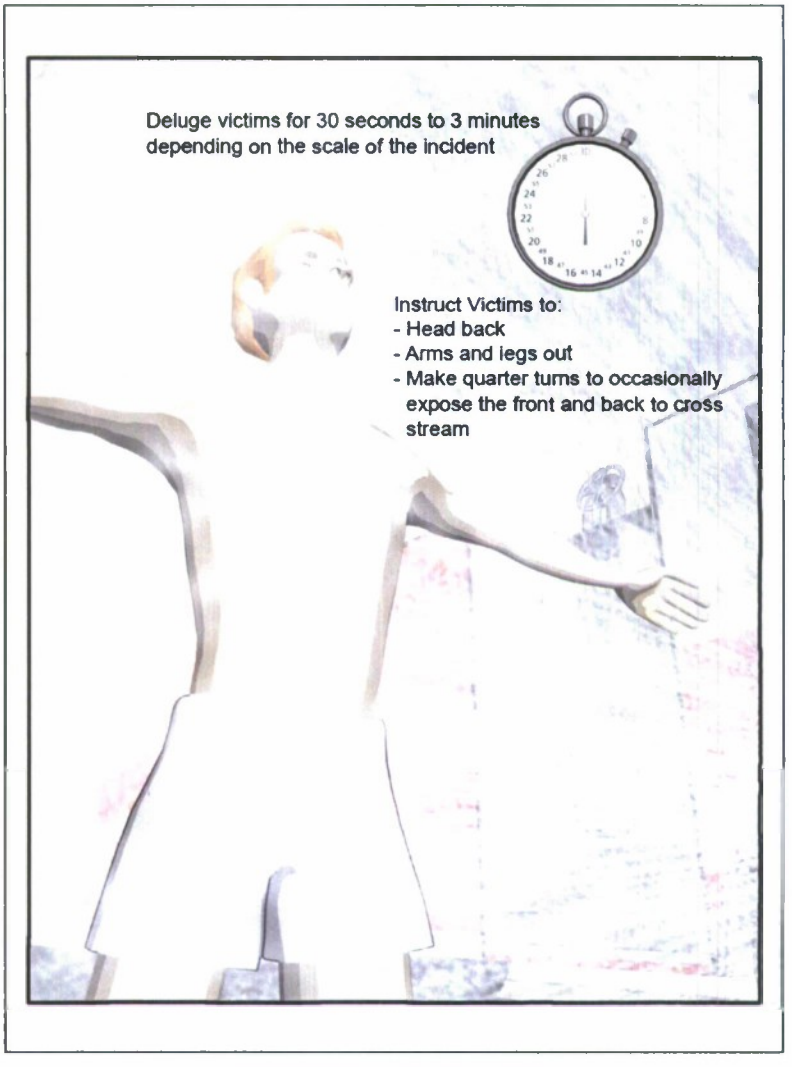


Figure 8-2. Proper Body Position for Mass Decontamination

When the contamination involves oily, liquid chemical agent (e.g., sulfur mustard), rubbing without the aid of soap is not recommended, as it may increase spread of the agent over a larger surface area of the body, resulting in increased medical risk.

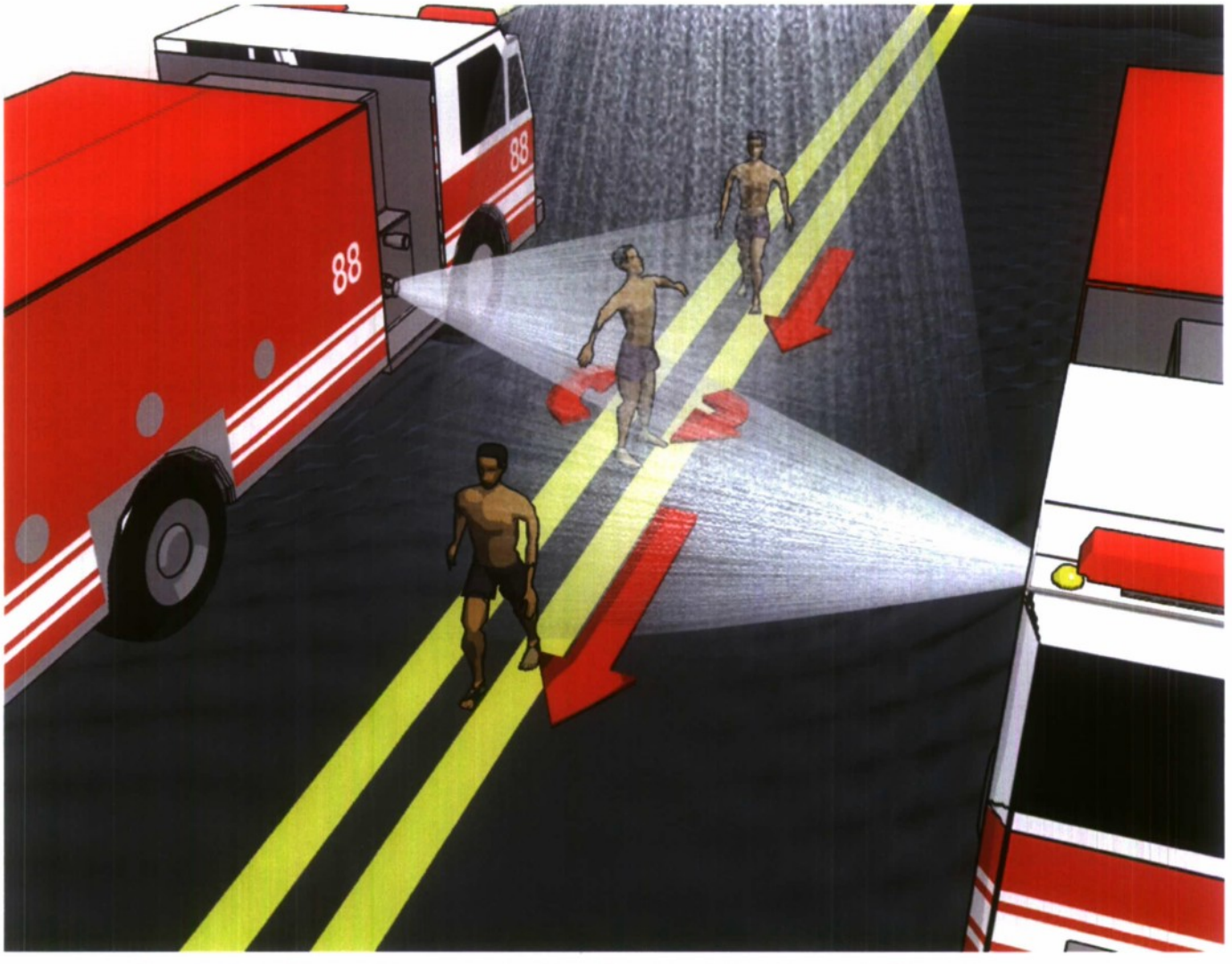


Figure 8-3. Proper Decontamination Corridor Walk-through Technique

By outstretching the arms and legs, tilting the head back, and occasionally turning 90 degrees (1/4 turn), the victim illustrated in Figure 8-3 demonstrates proper technique for proceeding through the decontamination corridor. By tilting his head back the victim keeps any contamination that might be in his hair or on his head from entering his eyes or mouth. Spreading the arms and legs allows the victim to expose his armpit and groin areas to the water shower. By turning 90 degrees (1/4 turn) at least once while passing through the decontamination corridor, the victim ensures that the front and back of his torso are exposed to the cross stream of water.

Figure 8-4. Decontamination Using Decontamination Corridor Setup

The responders in Figure 8-4 successfully perform mass decontamination. The responder at the top of the illustration directs victims into the decontamination corridor. A second responder in the same location instructs victims on proper technique for passing through the corridor. The responder at the bottom of the illustration conducts a quick visual inspection of the victims as they exit and directs them to the observation area, to medical treatment, or to secondary decontamination. As shown, deck guns can be positioned to provide additional water volume, if necessary.

Note: When liquid contamination is involved, soap should be included as soon as possible in the process <u>WITHOUT DELAYING</u> initial decontamination. Soap may be delayed until secondary decontamination if adding it would delay initial decontamination.

9.0 High-Volume, Low-Pressure Decontamination

Figure 9-1 portrays the Ladder Pipe Decontamination System (LDS). The LDS is one example of an expedient equipment set up for establishing high-volume, low-pressure decontamination.

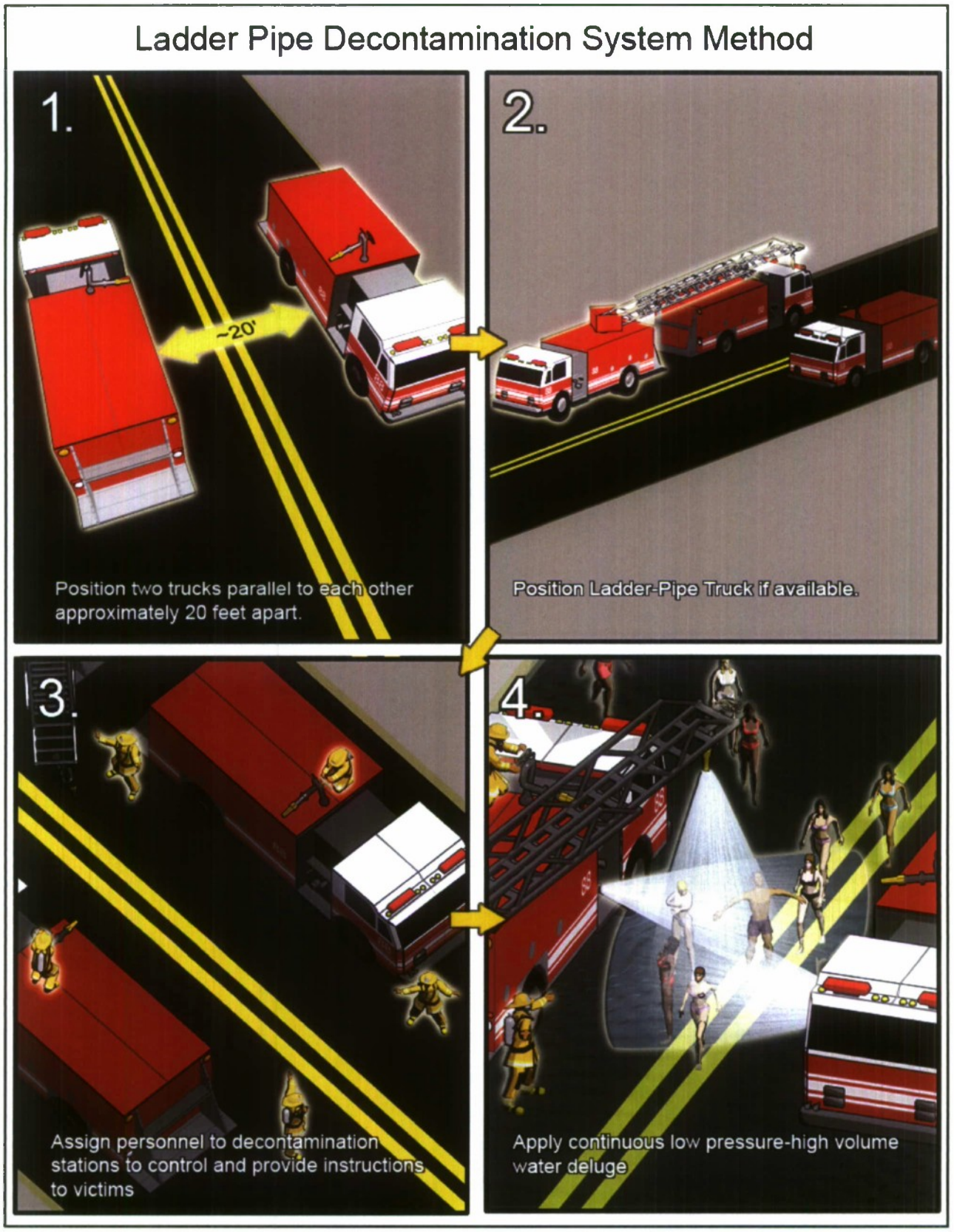


Figure 9-1. Ladder Pipe Decontamination System

The LDS provides a large capacity, high-volume, low-pressure water shower. Ladder pipes, deck guns, and fog nozzles are positioned strategically to create a mass decontamination corridor.

Two engines can create a corridor with water spray from both sides using hose lines and deck guns, while the ladder pipe provides high-volume, low-pressure water flow from above. Multiple LDSs use more than one ladder pipe to increase the length of the decontamination corridor to accommodate large groups of victims. Multiple corridors can be established to provide decontamination for different groups, such as ambulatory and non-ambulatory victims or even to provide decontamination at hospitals.

Responders should establish a mass decontamination system utilizing available resources that enables them to rapidly establish a high-volume, low-pressure water shower decontamination operation.

General Rules for HAZMAT/WMD Mass Casualty Decontamination

1 - Removing clothes is the single most critical step in mass decontamination and may remove 80-90% of physical contamination.
2 - Do not delay removal of clothes or application of a high-volume, low pressure water shower to set up tents, additional equipment or to create a soap-water solution. The water shower will dilute and remove contamination from the body.
3 –Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
4 - Wash time should be between 30 seconds and three minutes, depending on the situation.
5 - When the contamination **involves chemical vapors, biological or radiological material**, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of the contamination.
6 - Rubbing should start with the head and proceed down the body to the feet.
7 - Victim observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
8 - Secondary decontamination should be performed as necessary.

Special Considerations

Non-liquid

- If responders suspect the contamination is biological, radiological, or a gas/vapor, a water-only shower is typically adequate.

Liquid

- A secondary decontamination shower that includes a soap-water solution will likely be required for liquid contamination to ensure effective physical removal of agent.
- When removing liquid chemical contamination (e.g., sulfur mustard), rubbing without the aid of soap is not recommended as it may increase spread of the agent over a larger surface area of the body, resulting in increased medical risk.

10.0 Cold Weather Guidelines

Even in cold weather conditions, it is still most practical to conduct your decontamination effort outdoors. The healthy human body can withstand very low temperatures for a brief amount of time. The recommended basic methods of decontamination, immediate clothing removal and a high-volume, low-pressure shower, remain the same for temperatures as low as 36°F. Once victims are decontaminated, they should be provided with clothing/cover and moved to a heated facility. For temperatures 35°F and below, removal of clothing and a "dry" decontamination method for removal of liquid contamination may be used outdoors, such as blotting with paper towel, followed by high-volume, low-pressure water shower at a heated facility. Figure 10-2 on the next page provides a simple guide that indicates appropriate cold weather decontamination procedures.

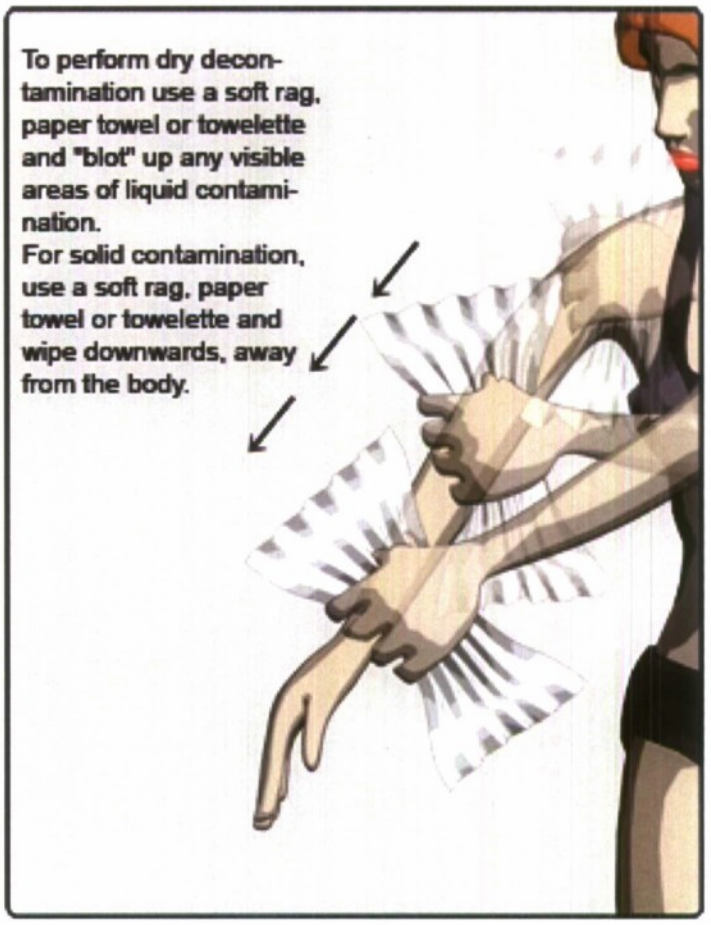


Figure 10-1. Dry Decontamination

Note: In a mass casualty decontamination situation in extreme cold (<36 degrees), decontamination with water could create a greater hazard and result in more cold weather casualties than the contamination hazard.

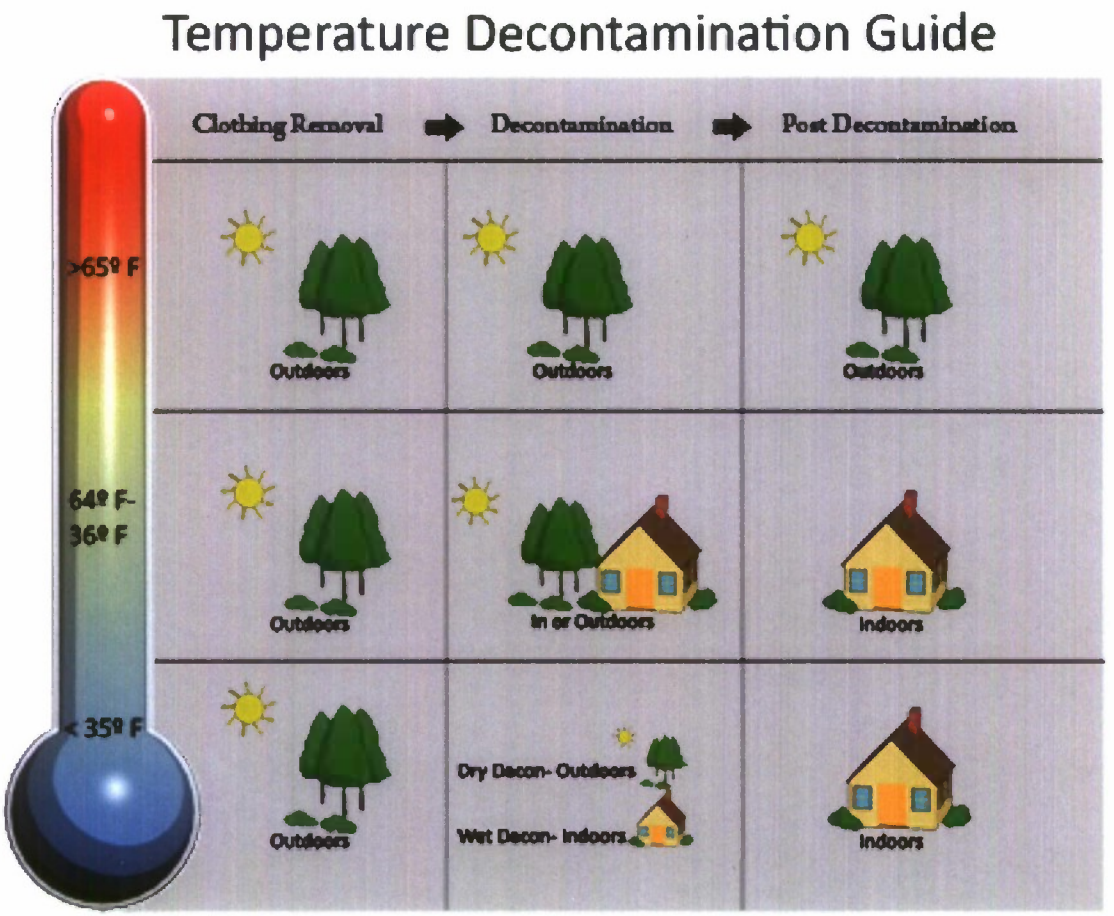


Figure 10-2. Cold Weather Decontamination Guide

General Rules for Cold Weather Decontamination

1 - Conduct some form of decontamination regardless of temperature conditions.
2 - Remove clothing outdoors
3 - If victims are outdoors in very low temperatures **(<36°F)** , use a dry method of decontamination (e.g., removal of clothing, blotting) instead of water for liquid contamination.
4 - After dry decontamination, victims should be moved inside or to a heated area for water/soapy water high-volume, low-pressure water shower and to mitigate the effects of cold weather.
5 – Observe for signs of hypothermia, delayed symptoms and completeness of decontamination.
6 - Follow all other General Rules for Mass Casualty Decontamination

11.0 Summary

The key to successful mass decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the victims. There is no perfect solution that can account for every variable and ensure rapid, completely effective decontamination of large numbers of victims for all hazards.

First responders will have to determine the need for mass decontamination; the extent and practicality of performing decontamination triage; the scope of resources needed versus resources available; the need for application of soap; and whether soap can be rapidly applied during initial decontamination or will have to be delayed until secondary decontamination can be performed.

Appendix A of Volume I contains the checklists and, where applicable, supporting graphics for each of the five steps described in section 7.0, as well as an overall checklist that may be used by the Incident Commander, Operations Chief, or Decontamination Team Leader. These checklists and graphics are designed to be removed and used by responders as a ready reference during any mass decontamination situation.

Appendix A: Quick Reference Guides for Mass Decontamination

The following pages are designed to be stand alone, quick reference checklists and supporting graphics that concisely capture information to aid first responders in a mass decontamination situation for a HAZMAT/WMD incident. This section is meant to be printed double-sided so that the supporting graphics are on the reverse side of the checklist.

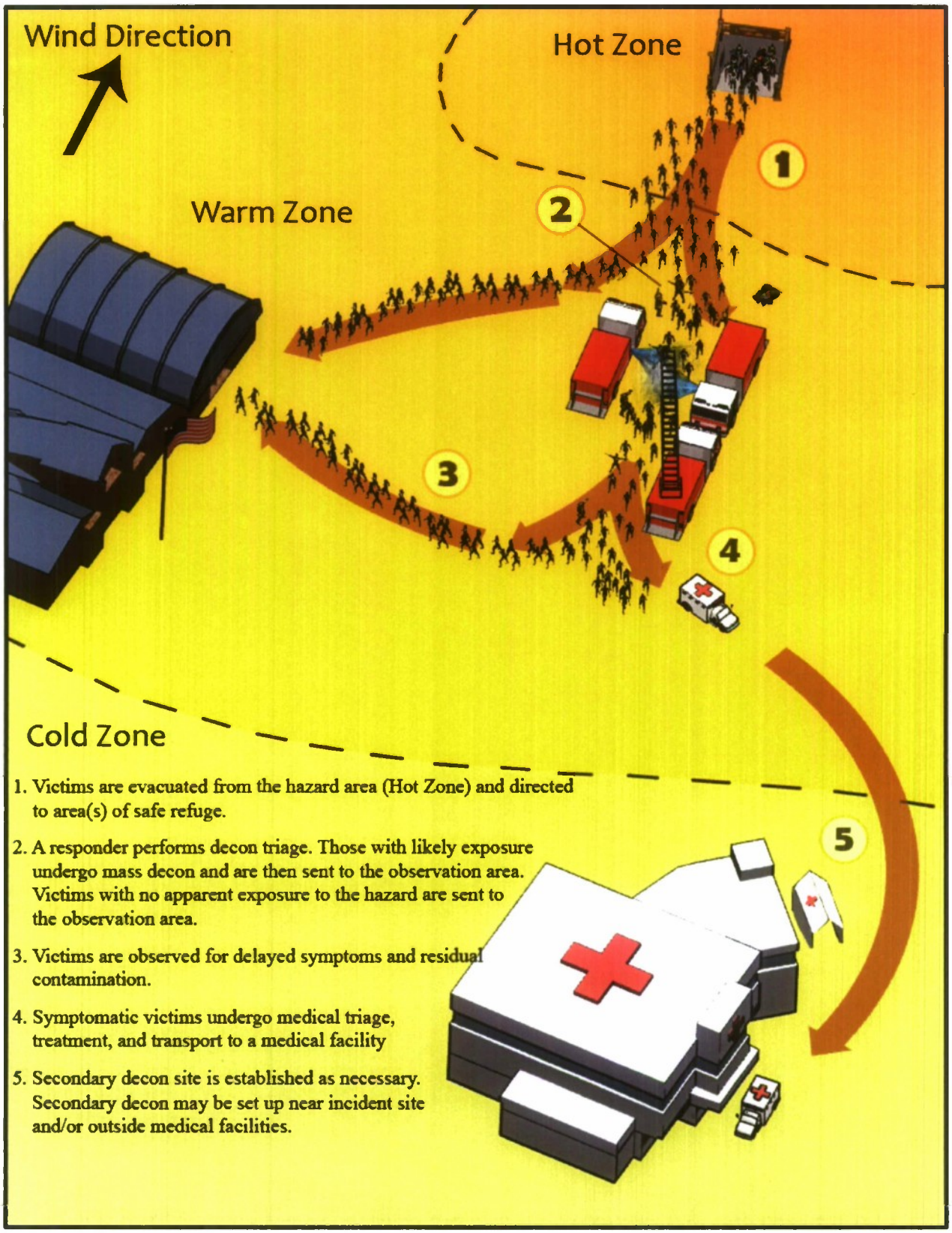
Guidelines for HAZMAT/WMD Mass Casualty Decontamination

INCIDENT COMMANDER'S OVERVIEW CHECKLIST

- ☐ Determine wind direction and establish safe area for decontamination set up.
- ☐ Establish a visible command post.
- ☐ Conduct scene safety assessment, to include secondary devices.
- ☐ Protect yourself.
- ☐ Approximate number of casualties.
- ☐ Determine type/state (liquid, solid or gas) of the hazard.
- ☐ Assess risks and determine need for decontamination.
- ☐ Conduct Decontamination Triage to prioritize victims.
- ☐ Communicate decontamination process to the victims (e.g., remove garments down to underwear immediately).
- ☐ Notify medical facilities.
- ☐ Establish perimeter/zones.
- ☐ Set up decontamination site.
- ☐ Execute decontamination.
- ☐ Observe victims for delayed symptoms.
- ☐ Perform Secondary decontamination (as necessary).
- ☐ Transport casualties to medical facility (as necessary).

When responders are unable to determine if actual chemical agent exposure has occurred, and in those situations where actual exposure appears unlikely, decontamination should be deferred PENDING OBSERVATION AND/OR SCENE INVESTIGATION. If symptoms develop, individuals should be treated followed by prompt field decontamination by the most expeditious means available.

Mass Decontamination Process



1. Victims are evacuated from the hazard area (Hot Zone) and directed to area(s) of safe refuge.
2. A responder performs decon triage. Those with likely exposure undergo mass decon and are then sent to the observation area. Victims with no apparent exposure to the hazard are sent to the observation area.
3. Victims are observed for delayed symptoms and residual contamination.
4. Symptomatic victims undergo medical triage, treatment, and transport to a medical facility
5. Secondary decon site is established as necessary. Secondary decon may be set up near incident site and/or outside medical facilities.

Guidelines for HAZMAT/WMD Mass Casualty Decontamination

INITIAL SIZE-UP CHECKLIST

- ☐ Communicate the incident to first responders.
- ☐ Conduct scene safety assessment.
- ☐ Do not rush into the incident scene – protect yourself.
- ☐ Local law enforcement should check for possible secondary devices near decontamination site.
- ☐ Look for signs and symptoms of exposure and utilize detectors, if available.
- ☐ Estimate how many suspected victims are involved.
- ☐ Determine whether mass decontamination is required.
- ☐ Determine what resources are needed and readily available for mass decontamination.
- ☐ Determine the impact of weather conditions on decontamination operations (temperature, wind speed, wind direction).
- ☐ Decontamination should be set up upwind from the incident. If the temperature is below 65°F, consider cold weather decontamination.
- ☐ Alert hospitals to prepare for victims exposed to contamination.

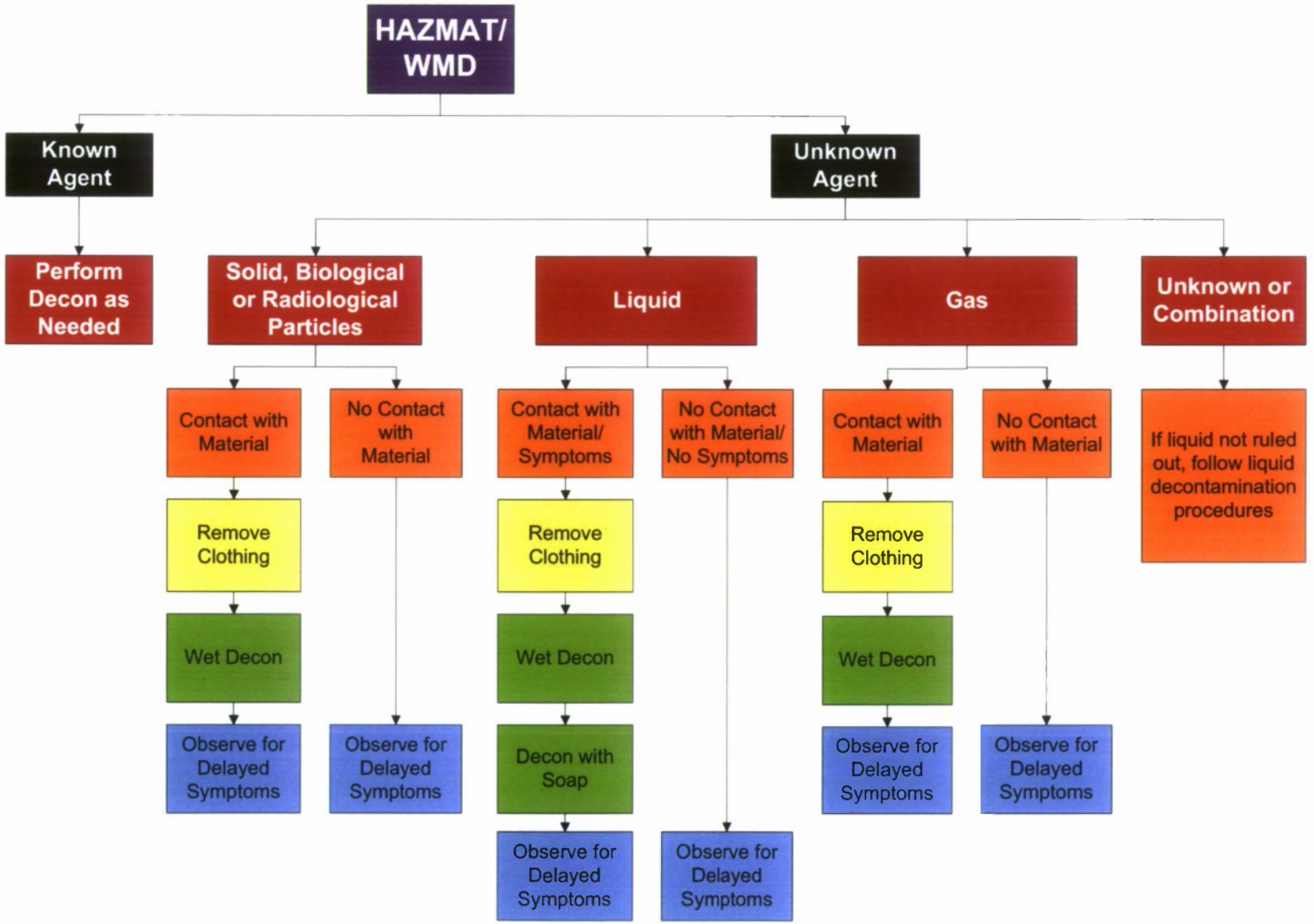
Guidelines for HAZMAT/WMD Mass Casualty Decontamination

VICTIM CONTROL/DECONTAMINATION TRIAGE CHECKLIST

- ☐ ***Ensure all responders are properly protected.***
- ☐ Gain control of the victims as rapidly as possible (public address systems, instructional signs) and direct victims to area(s) of safe refuge to begin decontamination or for observation.
- ☐ In multi-lingual communities, use multi-lingual or illustrated signs to provide instructions to victims.
- ☐ Perform decontamination triage by separating and prioritizing victims into categories in preparation for mass decontamination (see Decontamination Triage Tree on reverse).
    - ❖ Non-ambulatory
    - ❖ Ambulatory and symptomatic
    - ❖ Ambulatory, non-symptomatic, exposed to contaminant
    - ❖ Ambulatory, non-symptomatic, no obvious exposure to contaminant

Note: it is possible that the severity of conventional injuries may require that certain victims receive an elevated priority, regardless of whether they are showing obvious signs/symptoms of exposure.

- ☐ **ENCOURAGE VICTIMS TO REMOVE AS MUCH CLOTHING AS POSSIBLE, BUT AT LEAST REMOVE OUTER GARMENTS DOWN TO UNDERWEAR.** Cutting and/or unbuttoning is preferred to pulling clothing over the head.
- ☐ If clothes must be lifted over the head, instruct victims to do so carefully by placing hands and arms inside the garment and using the hands to pull the head opening away from the face and head as much as possible.


HAZMAT/ WMD
Known Agent
Unknown Agent
Perform Decon as Needed
Solid, Biological or Radiological Particles
Liquid
Gas
Unknown or Combination
Contact with Material
No Contact with Material
Contact with Material/ Symptoms
No Contact with Material/ No Symptoms
Contact with Material
No Contact with Material
If liquid not ruled out, follow liquid decontamination procedures
Remove Clothing
Remove Clothing
Remove Clothing
Wet Decon
Wet Decon
Wet Decon
Observe for Delayed Symptoms
Observe for Delayed Symptoms
Decon with Soap
Observe for Delayed Symptoms
Observe for Delayed Symptoms
Observe for Delayed Symptoms
Observe for Delayed Symptoms

Guidelines for HAZMAT/WMD Mass Casualty Decontamination

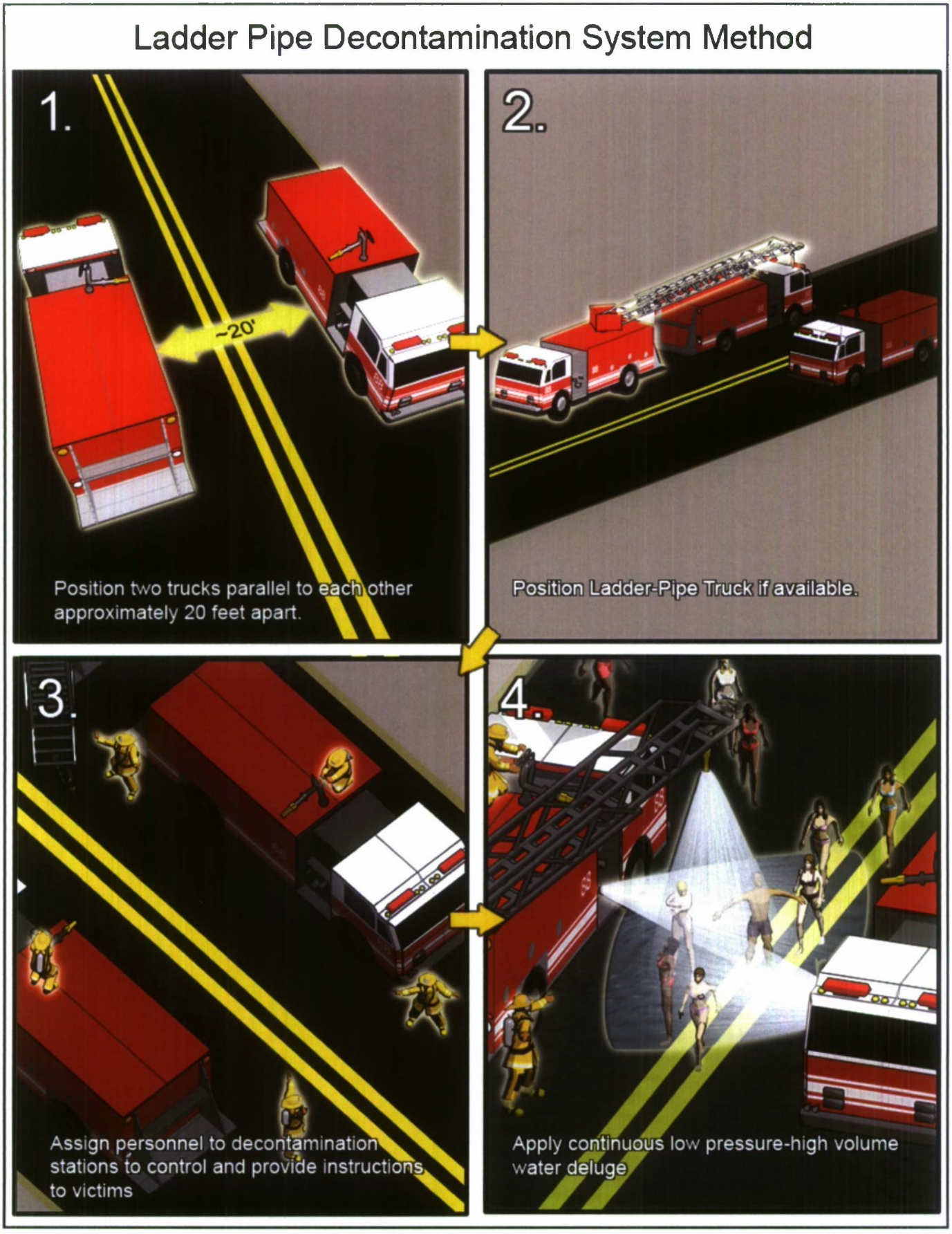
DECONTAMINATION SETUP CHECKLIST

- ☐ ***Ensure all responders are properly protected.***
- ☐ Local law enforcement should check for possible secondary devices near the selected decontamination site(s).
- ☐ Establish Hot/Warm/Cold zones. Set up barriers or police tape to delineate zones. Post signs directing victims on where to go and what to do.
- ☐ **If not already accomplished,** instruct victims to remove as much clothing as possible. Cutting and unbuttoning is preferred to pulling clothing over the head. Collect clothing in the Warm zone.
- ☐ Set up decontamination site upwind of the hot zone. Ideally, it should be uphill from the hot zone, easily accessible for responders, and have good drainage.
- ☐ Suggested setup: Ladder Pipe Decontamination System (or other expedient system) to dispense high-volume, low-pressure water (~60 psi) with wide fog pattern.

Note: Decontamination of exposed and/or symptomatic victims should not wait for set up of decontamination tents or additives such as soap,

- ☐ Establish victim observation area(s) and secondary decontamination area(s) as necessary.

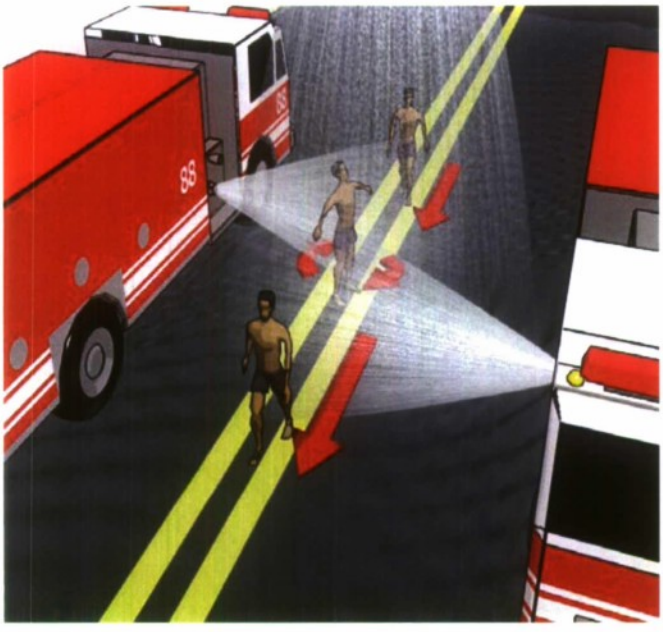
Ladder Pipe Decontamination System Method



Guidelines for HAZMAT/WMD Mass Casualty Decontamination

MASS DECONTAMINATION EXECUTION CHECKLIST

- ☐ Instruct victims to move to specific areas depending on medical and decontamination triage status.
- ☐ **If not already accomplished,** instruct victims to remove as much clothing as possible.
- ☐ Establish a method for collecting and tracking personal items (e.g., bag labeled with victim name/number).
- ☐ Based on decontamination triage prioritization, instruct victims to move through the decontamination corridor. Wash time should be between 30 seconds and three minutes. Do not delay the high-volume, low pressure water shower to create a soap-water solution
- ☐ Instruct victims to:
  - ❖ Tilt head back.
  - ❖ Raise and spread arms and spread legs to expose armpits and groin.
  - ❖ Walk through shower system slowly, and periodically turn 90 degrees (1/4 turn).
  - ❖ When the contamination involves chemical vapor, biological or radiological materials, victims should apply gentle friction by using their hands, a cloth, or a sponge to aid in removal of contamination.
  - ❖ Rubbing should start with the head and proceed down the body to the feet.
  - ❖ When the contamination is a liquid chemical agent, DO NOT apply friction without the aid of soap as this may spread the hazard over the body and increase medical risk.
- ☐ After passing through decontamination corridor, provide victims with clothing/cover.
- ☐ Use some means to identify victims that have been decontaminated.
- ☐ Direct symptomatic patients to additional treatment or secondary decontamination area(s) as appropriate.
- ☐ Direct non-symptomatic victims to observation area(s).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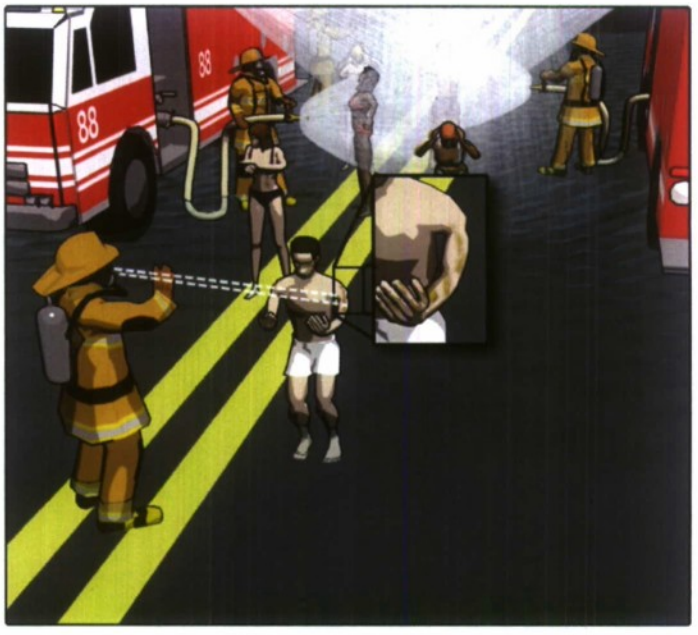
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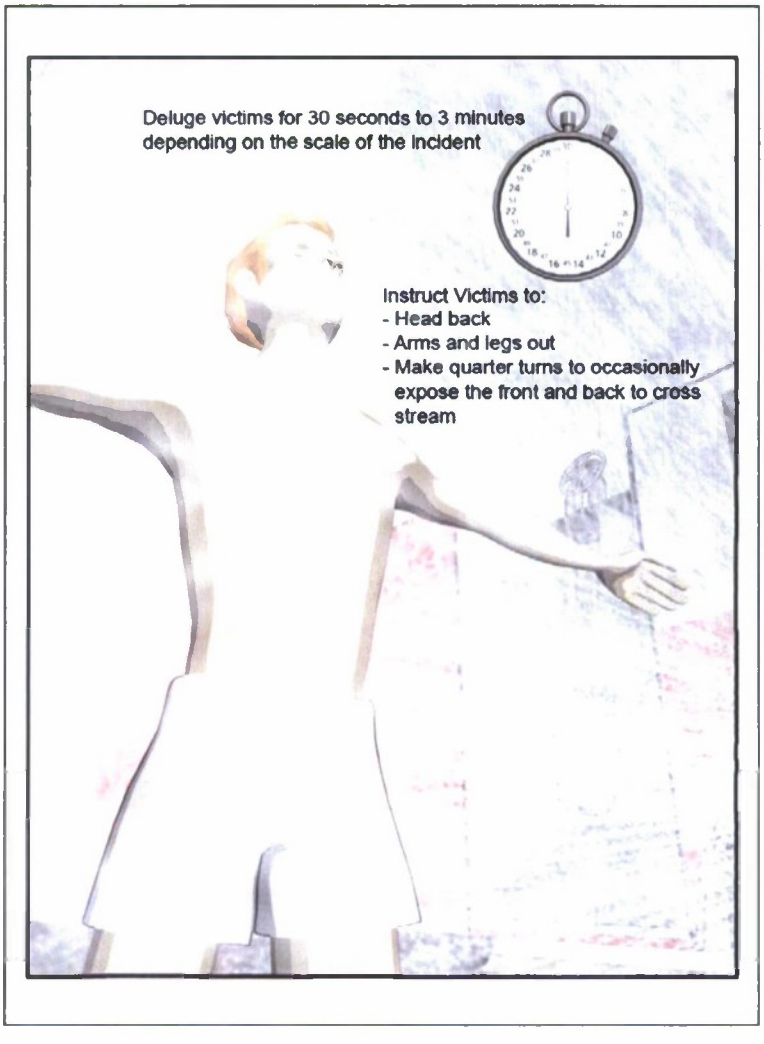
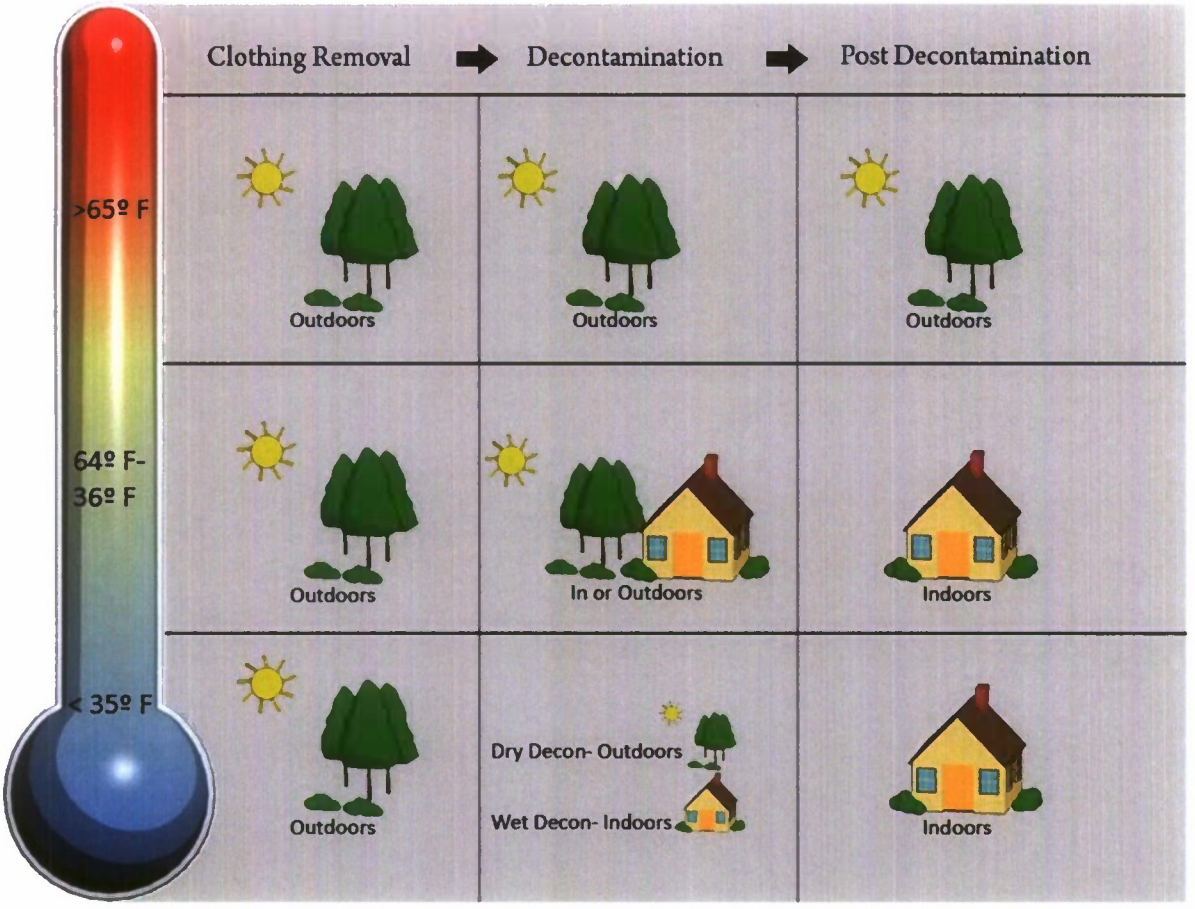

Deluge victims for 30 seconds to 3 minutes depending on the scale of the incident
Instruct Victims to:
- Head back
- Arms and legs out
- Make quarter turns to occasionally expose the front and back to cross stream

Guidelines for HAZMAT/WMD Mass Casualty Decontamination

COLD WEATHER DECONTAMINATION (<65°F) CHECKLIST

- ☐ Conduct some form of decontamination regardless of temperature conditions.
- ☐ Remove clothing outdoors
- ☐ If victims are outdoors in very low temperatures **(<36°F)** , use a dry method of decontamination (e.g., removal of clothing, blotting) instead of water for liquid contamination.
- ☐ After dry decontamination, victims should be moved inside or to a heated area for water/soapy water high-volume, low-pressure water shower and to mitigate the effects of cold weather.
- ☐ Physically identify decontaminated victims (e.g., tag around neck).
- ☐ Observe for signs of hypothermia, delayed symptoms and completeness of decontamination.
- ☐ Follow all other General Rules for Mass Casualty Decontamination

Temperature Decontamination Guide



Guidelines for HAZMAT/WMD Mass Casualty Decontamination

POST DECONTAMINATION CHECKLIST

- ☐ Observe victims for delayed symptoms and completeness of decontamination.
- ☐ Perform secondary decontamination as necessary.
- ☐ Transport symptomatic victims to medical facilities for assistance.
- ☐ Arrange for clothing/cover and possible recovery of personal effects.
- ☐ Collect contaminated personal items for possible decontamination.
- ☐ Provide follow-up information to the victims (e.g., symptoms to watch for).
- ☐ Provide instructions to victims prior to release (e.g., care, follow-up).
- ☐ Decontaminate all responders, equipment, and incident site.
- ☐ Conduct medical check on all responders.
- ☐ Complete victim and first responder documentation and accountability.

Appendix B: Glossary

Ambulatory – Victims able to understand directions, talk, and walk unassisted.

Casualty – An inured person.

Cold Zone – Uncontaminated area of a HAZMAT incident site.

Deck gun – Aimable, controllable high-capacity water jet used for manual firefighting.

Decontamination Triage – Prioritization of victims for decontamination based on injury and evidence of contamination and/or exposure to the hazard.

Fog nozzle – Firefighting hose nozzle that separates water into droplets.

Hazardous Material (HAZMAT) – Any item or agent with potential to cause harm to humans and animals.

Hoseline – A thick, high-pressure hose used to carry water to a fire to extinguish it.

Hot Zone – Contaminated area of HAZMAT incident that must be isolated and requires suitable protective equipment to enter and decontamination upon exit.

Ladder pipe – Nozzle attached to aerial ladder and used to direct a heavy stream of water.

Mass Casualty – Any large number of casualties produced in a relatively short period of time, usually as the result of a single incident.

Mass Decontamination – Decontamination of large numbers of people, in the event of contamination by a harmful substance.

Neutralization – Counteraction of the effects of a hazardous substance.

Non-ambulatory – Victims who are unconscious, unresponsive, or unable to move without assistance.

Sarin – An extremely toxic nerve agent; also known as GB.

Toxic Industrial Chemical (TIC) – Chemical compounds used or produced in industrial processes that are toxic to humans.

Toxic Industrial Material (TIM) – Toxic radioactive compounds used or stored by industry.

Triage – Evaluation of exposed individuals based on type and seriousness of injury for the purpose of decontamination prioritization.

Warm Zone – Area where personnel, equipment decontamination, and hot zone support takes place.

Weapon of Mass Destruction (WMD) – Weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people.

Appendix C: Acronym List

CBR – Chemical, biological, radiological

HAZMAT – Hazardous material

LDS – Ladder-Pipe Decontamination System

TIC – Toxic Industrial Chemical

TIM – Toxic Industrial Material

WMD – Weapon of Mass Destruction

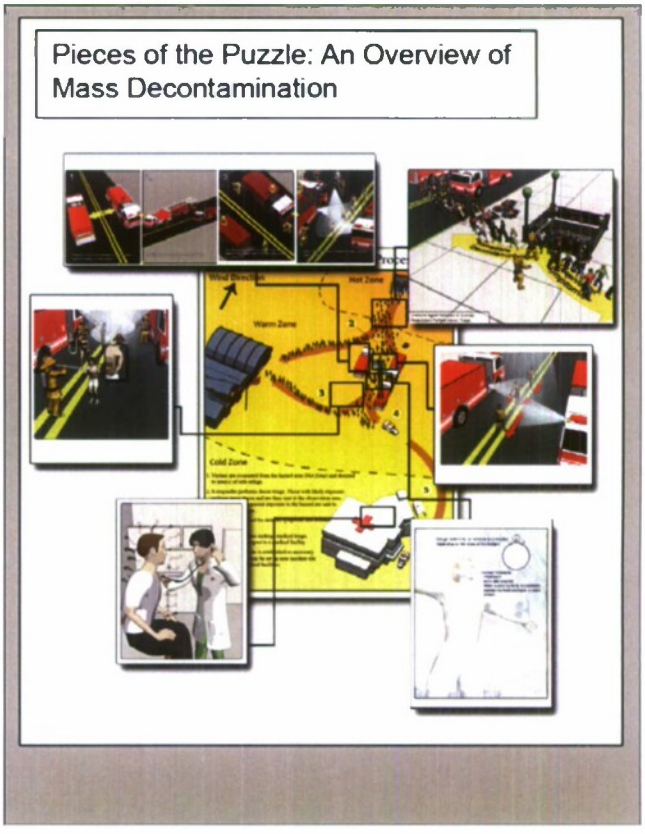
Principles of Mass Decontamination

- ***Removing clothes is the single most critical step in mass decontamination and may remove 80-90% of physical contamination.***
- ***Do not delay removal of clothes or application of a high-volume, low pressure water shower to set up tents, additional equipment or to create a soap-water solution.***
- Conduct decontamination triage prior to administering a high-volume, low-pressure water shower (~60 psi)
- Wash time should be between 30 seconds and three minutes, depending on the situation
- When the contamination **involves chemical vapors, biological or radiological material**, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of the contamination
- Rubbing should start with the head and proceed down the body to the feet
- Victim observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination
- Perform secondary decontamination as necessary

The key to successful mass decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people.

Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident

Volume II of II Supplemental Information



Prepared by:

U.S. Army Chemical Biological, Radiological and Nuclear School and U.S. Army Edgewood Chemical Biological Center

April 2009

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GUIDELINES FOR MASS CASUALTY DECONTAMINATION DURING A HAZMAT/WEAPON OF MASS DESTRUCTION INCIDENT VOLUME II OF II SUPPLEMENTAL INFORMATION

1.0 Introduction

In the recent past, terrorist organizations have used different chemical, biological, and radiological (CBR) weapons to pursue their own agendas. In 1995, the Aum Shinrikyo cult released sarin onto the Tokyo subway system, killing 12 and injuring hundreds. In 2001, anthrax spores were sent through the U.S. Postal Service killing five postal employees and infecting 22 others. The increasing complexity and scale of these incidents suggest the possibility of a large scale attack with a Weapon of Mass Destruction (WMD) causing thousands of casualties on U.S. soil. Since these attacks are difficult to prevent and may happen anywhere and at any time, mass decontamination is one of the key elements to managing the consequences of such an event, saving lives, and limiting the number of injuries.

2.0 Background

These Guidelines are an update of the United States Army Soldier and Biological Chemical Command (SBCCOM) - now the United States Army Edgewood Chemical Biological Center (ECBC) - January 2000 *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident* and January 2002 *Guidelines for Cold Weather Mass Decontamination During a Terrorist Chemical Agent Incident*. These Guidelines supersede these original 2000 and 2002 Guidelines and are expanded to include all chemical, biological and radiological hazards. These Guidelines represent the latest evolution in our approach to mass casualty decontamination.

3.0 Objective

These Guidelines were developed for first responders to provide information and suggested procedures for mass casualty decontamination following a hazardous materials (HAZMAT)/WMD attack.

There is no perfect solution to mass casualty decontamination and no single process or method can account for all variables (e.g., hazard, time, number of victims, environmental conditions, resources). These updated Guidelines are intended to identify a simple, consistent mass decontamination process that could be applied with reasonable effectiveness to any HAZMAT/WMD incident. In other words, *use the fastest approach that will cause the least harm and do the most good for the majority of the people.*

Volume I of these Guidelines focused on providing responders succinct instructions, to include checklists, for performing mass casualty decontamination. Volume II provides supporting information and the reasoning behind the procedures outlined in Volume I.

4.0 Scope

These Guidelines are based on exposure to all hazards and focus on civilian mass casualty decontamination. These Guidelines primarily focus on chemical, biological, and radiological (CBR) agents, but also include Toxic Industrial Chemicals (TICs), Toxic Industrial Materials (TIMs), and toxins (collectively referred to in this document as HAZMAT/WMD). These Guidelines do not cover each type of threat individually, however, the basic principles outlined are applicable to all HAZMAT/WMD situations.

This document addresses the decontamination of an overwhelming number of victims resulting from a HAZMAT/WMD incident in a population center. Mass casualty decontamination requires slightly different approaches than the individual technical and equipment decontamination applied during typical HAZMAT incidents. This document does not address secondary, technical or equipment decontamination.

These Guidelines are designed for use during the first minutes of a mass casualty HAZMAT/WMD incident to reduce contamination and minimize casualties.

5.0 Guidelines Format

These Guidelines are divided into two volumes:

5.1 Volume I

Volume I is a quick reference book and designed to be a short, concise description of procedures to set up and execute mass decontamination. Volume I is intended to be separated and distributed to team members during a mass casualty HAZMAT/WMD incident.

5.2 Volume II

Volume II is a more in-depth compendium of HAZMAT/WMD mass casualty decontamination. It contains the reasoning behind the procedures recommended in Volume I, a review of the Guidelines development process, reference sources, potential best practices, additional considerations, and information concerning the Working Group that developed these Guidelines.

Appendix A: Discussion of Mass Casualty Decontamination Operations

Volume I of these Guidelines identifies five basic steps for the process of mass decontamination:

1. Initial Size-up
2. Victim Control and Decontamination Triage
3. Decontamination Set-up
4. Mass Decontamination Conduct
5. Post Decontamination

These five Steps were described briefly in Volume I. Additional discussion and reasoning for each step is provided below.

1.0 Step 1: Initial Size-up

This step is performed in accordance with standard guidelines as contained in the Emergency Response Guide 2008 and National Fire Protection Association (NFPA) Standard 472 for first responders arriving at an incident scene.

When HAZMAT/WMD exposure is suspected, responders first perform a scene safety assessment and ensure they properly protect themselves and do not rush into an unknown situation. As previous events have demonstrated, it is necessary for responders to check for secondary devices that may be placed near the incident scene. Since mass decontamination results in the congregation of a large number of victims and responders, it is a natural target and the site(s) must be checked for secondary devices.

For HAZMAT/WMD incidents, responders will look to identify signs and symptoms of exposure to determine whether mass decontamination is necessary. Observing for symptoms generally only applies to chemical incidents, not counting injuries sustained as the result of an explosive dissemination device or injuries suffered while evacuating the hazard area. Physical evidence of exposure includes victims covered with a liquid or solid, which can be the result of contamination from chemical, biological and radiological incidents. It is particularly important to identify victims exposed to liquid contamination, especially oily agents such as nerve and mustard, as liquids require the application of soap or other emulsifiers to most effectively remove the agent from the victims' hair and skin. If equipped, responders can also use detection devices to rapidly determine the presence of chemical, biological or radiological contamination. Biological detection devices generally take several minutes or longer to produce results.

Since mass decontamination is resource intensive, determination of the need for decontamination during the size-up is an important step.

The environment needs to be considered when determining where and how to execute decontamination. Follow cold weather guidelines (especially during extreme cold weather (temperatures below 65 degrees Fahrenheit)) when exposure to the cold and wet decontamination may generate a greater number of, or more severe, casualties than the HAZMAT/WMD hazard.

2.0 Step 2: Victim Control and Decontamination Triage

This step involves gaining initial control of the victims so responders can provide victims with guidance and instruction, to include removal of clothing and prioritizing victims for decontamination.

2.1 Gaining Control of Victims

Gaining control of victims is a difficult task, but rapidly gaining control is critical to getting victims to quickly perform the critical first step in mass decontamination – removal of their clothing down to undergarments. Responders are not only challenged with guiding and controlling victims while wearing protective clothing, but also must try to avoid being exposed to cross contamination. The use of communication devices such as public address systems and signs may prove effective. Illustrated signs (with or without text) may prove effective in multi-lingual communities. The use of physical barriers may prove effective in gaining initial control of victims and preventing the spread of contamination. Victims should be evacuated from the hazard area and directed to area(s) of safe refuge. Those victims who were likely exposed to the hazard should be directed to an area of safe refuge where they should be instructed to begin the decontamination process by removing clothing. Those victims who were likely not exposed to the hazard should be directed to an area of safe refuge for observation.

2.2 Victim Clothing Removal

Removal of victims' clothing is the single most critical action for effective mass decontamination. Having a victim remove their clothes will significantly reduce risk in all cases. Victims should be encouraged to immediately remove as much clothing as possible – the more clothing removed the better. At a minimum, victims should remove outer garments down to their underwear.

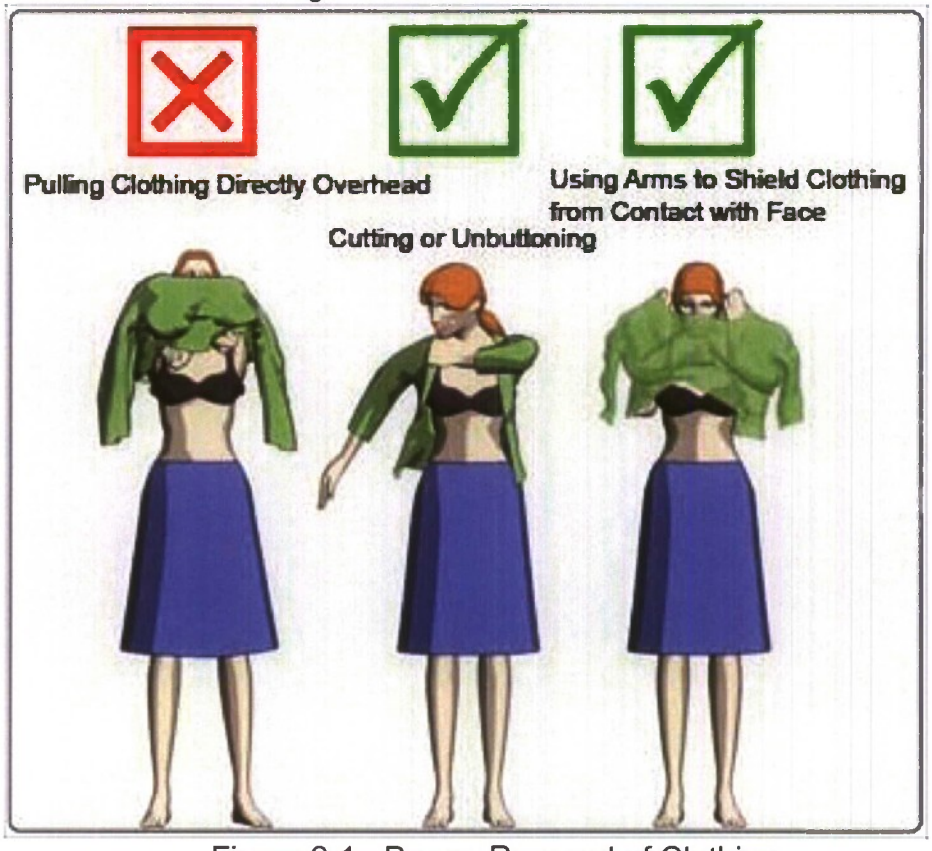

Figure 2-1. Proper Removal of Clothing

Removal of clothes down to the underwear is considered the most expedient solution. Though removal of all clothing would be most effective, making this action a requirement may cause many citizens to become uncooperative and potentially delay the mass decontamination process. Removal of clothing down to the

underwear is an effective compromise for all situations, with the exception of liquid contamination that has saturated outer clothing and contacted undergarments. This situation is considered a fairly low probability.

Whenever possible, victims should unbutton or cut clothes away rather than lift them over their head (Figure 2-1).

If clothes must be lifted over the head, instruct victims to do so carefully by placing hands and arms on the inside of the garment and using the hands to pull the head opening away from the face and head as much as possible. These precautions will reduce the chance of exposing the head, face and eyes to contamination.

It is the opinion of the scientists, doctors and responders who participated in the Working Group that removal of clothing down to the undergarments may remove as much as 80-90% of contamination from the victims. When most of the victim's skin is covered with clothing, such as long pants and shirts, there is a greater likelihood of significant or total contamination removal. During warm weather when shorts and short-sleeve shirts are common, it is likely that a higher percentage of contamination will be directly on the skin of the victims.

2.3 Decontamination Triage

Decontamination triage involves separating victims into prioritized groups. Rapidly identifying victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination. The term decontamination triage is not to be confused with medical triage. In the original Guideline, "decontamination prioritization" was used to avoid any confusion. However, decontamination triage is used in these updated Guidelines, since it is the experience of many of those in the Mass Decontamination Guidelines Working Group that the term is accepted and widely used in the response community.

Conducting decontamination triage, and determining the extent to which it is conducted, are decisions left to the discretion of responders at the incident scene. Based on time and resources, responders might reasonably elect to process all victims as rapidly as possible through mass decontamination rather than perform decontamination triage. If decontamination triage is conducted, victims should be separated according to the following priorities:

- Non-ambulatory
- Ambulatory and symptomatic
- Ambulatory, non-symptomatic, likely exposed to contaminant
- Ambulatory, non-symptomatic, no obvious exposure to contaminant

Triage Definitions

- **Ambulatory:** Victims able to understand directions, talk, and walk unassisted.
- **Non-Ambulatory:** Victims who are unconscious, unresponsive, or unable to move without assistance.

Non-ambulatory and ambulatory but symptomatic victims are the highest priority for decontamination and treatment. Depending on capabilities and the hazards involved, responders' local procedures may include medical treatment prior to decontamination for these victims.

The next priorities are victims who are not symptomatic, but show obvious signs of exposure to the contaminant or were likely exposed to the contaminant based on their proximity to the hazard. Because of the toxicity of many agents, these victims could rapidly suffer severe effects from agent exposure if not decontaminated as soon as possible after higher priority victims.

The last priorities are those victims who are ambulatory, non-symptomatic and who likely were not exposed to the hazard. It is possible that these victims may not require decontamination and can be sent to an observation area to more accurately determine the need to decontaminate them. However, if resources are available, it is reasonable that responders would elect to decontaminate all victims as an added degree of safety and precaution.

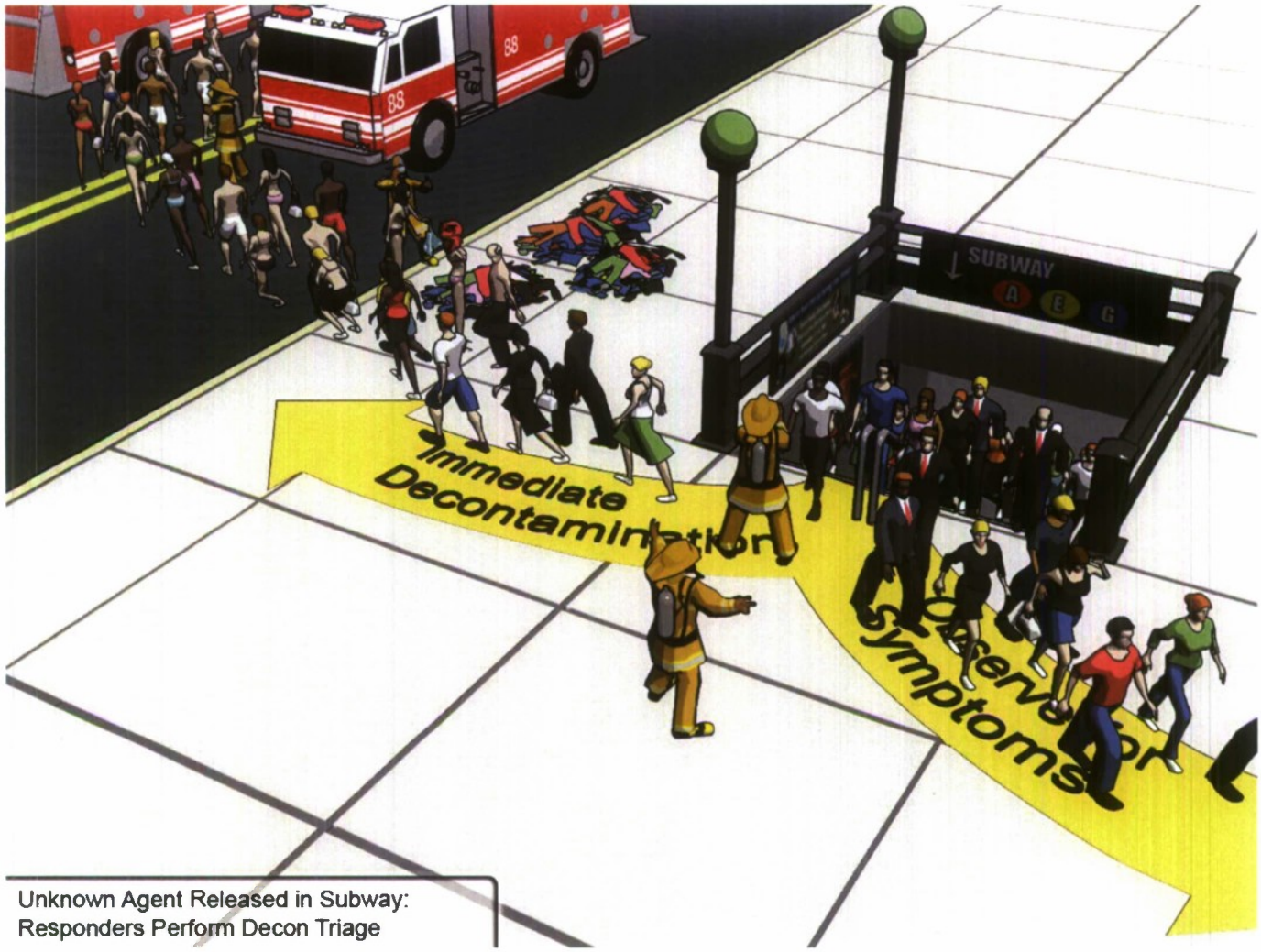

Figure 2-2. Decontamination Triage

Figure 2-2 represents victims evacuating from a train station following a HAZMAT/WMD attack. The responders at the top of the train station exit are performing rapid decontamination triage based on a) a quick questioning as to whether victims were in the vicinity of the hazard and b) visually observing for signs and symptoms of exposure. Those in the vicinity, or showing/indicating signs/symptoms of exposure, are sent to decontamination. Those likely not exposed and showing no signs of exposure are sent to an observation area.

Figure 2-3 is a decontamination triage tree to aid responders in performing decontamination triage. Note that for unknown contaminants or a combination of contaminants, unless liquid contamination can be eliminated as a source of the hazard, responders should follow guidelines for liquid decontamination, which includes application of soap during either initial or secondary decontamination.

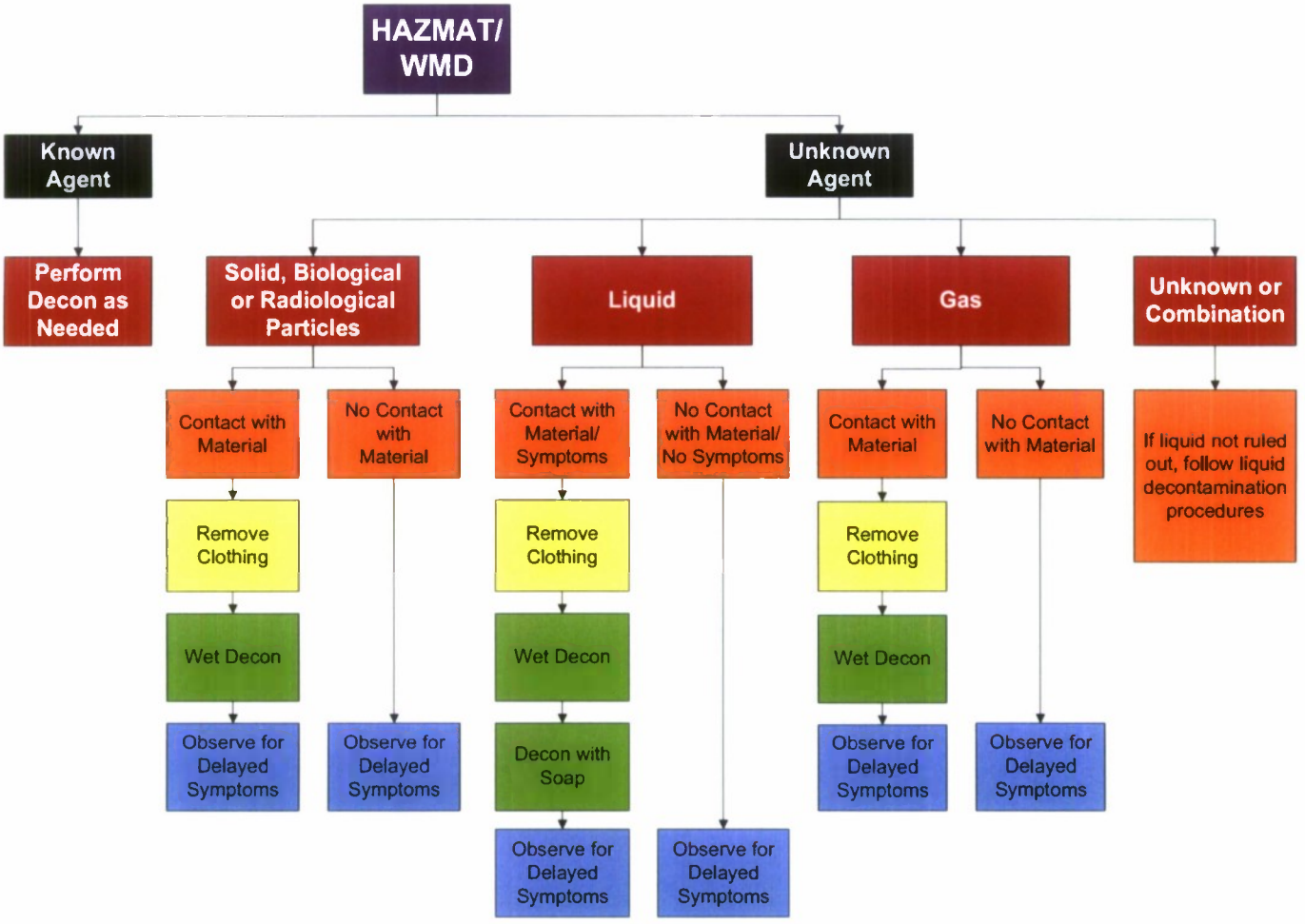

Figure 2-3. Mass Casualty Decontamination Triage Decision Tree

The decontamination triage decision tree is meant to be a simple tool to help plan for and respond to HAZMAT/WMD incidents.

When the contaminating material is known, especially when a conventional HAZMAT material is involved, responders should follow decontamination procedures as outlined in the Emergency Response Guide 2008, adapting the principals as outlined for mass decontamination as appropriate.

When the contaminant is a solid (such as radiological or biological particles) or vapor/gas, a water-only shower is satisfactory. Victims not exposed to the contaminant can be sent to an observation area or given lowest priority for decontamination.

When the contaminant involved is a liquid chemical agent, those exposed should be decontaminated at some point with soap and water. The decision tree shows application of water-only decontamination followed by a secondary soap and water decontamination. However, if adding soap to the initial water shower does not delay the start of decontamination, a single shower can be performed, followed by observation.

Note: It is possible that the severity of conventional injuries may require certain victims receive elevated priority, regardless of whether they are showing obvious signs/symptoms of exposure. This determination would be made by medical personnel performing medical triage.

3.0 Step 3: Decontamination Set-Up

This step includes establishing incident scene zones and setting up the decontamination site and operation.

3.1 Establishing Zones

Zones should be established in accordance with the Emergency Response Guide 2008 and other applicable HAZMAT references.

3.2 Set-up Mass Decontamination Water Shower System

Volume I, section 9.0, includes instructions and graphics detailing set-up of a simple Ladder Pipe Decontamination System (LDS).

The previous Guidelines contained instructions for setting up several methods of mass decontamination operations. However, for these update Guidelines, the LDS is the only system included due to its simplicity and expected application in a broad range of responder communities.

Although the variations for setting up mass decontamination systems are virtually limitless, many, to include methods portrayed in the original Guidelines, waste precious minutes to set up additional equipment (e.g., tents, tarps) and mix in additives.

Time is critical for effective decontamination. For fast acting agents, such as nerve agents, many victims will sustain serious injury or die within minutes of exposure. Even for chemical agents with delayed symptoms, such as mustard agents, rapid decontamination is critical. Though the physical symptoms associated with mustard agent poisoning are delayed, mustard agent starts damaging cells immediately upon contact with skin. Failure to rapidly decontaminate following chemical agent exposure could lead to severe illness or death, even for victims able to evacuate themselves from the hazard area.

In the case of biological and radiological contamination, where there will be no immediate health effects, the amount of biological or radiological contamination that enters the body through inhalation, ingestion or broken skin will determine the severity of any associated illness.

For these reasons, rapid application of the high-volume, low-pressure water shower is critical to the success of mass decontamination in limiting deaths and injuries, as well as reducing the spread of contamination, regardless of the type of hazard involved. The water shower physically removes and dilutes the hazard.

As with all HAZMAT/WMD operations, the decontamination site should be set-up upwind of the hazard area (Hot Zone). Whenever possible, the site should be uphill from the Hot Zone and have good drainage.

4.0 Step 4: Mass Decontamination Conduct

Step 4 outlines procedures for decontaminating a large number of victims. This section includes instructions on proper clothing removal (ideally completed prior to establishing the water shower system), proper procedure for walking through the decontamination shower corridor, identification of decontaminated victims, and directing decontaminated victims to an observation area to monitor for delayed symptoms or the need for additional decontamination.

Victim Instructions

Removal of Clothes. Victims should be instructed to carefully remove clothes and place them in piles. If possible, responders should provide a means to separate and collect personal items and clothes. Victims will likely want to maintain possession of purses and wallets. In many cases this will present minimal hazard. However, in situations where the personal items are visibly contaminated with a liquid or solid, these items pose a risk to the victims and others and must be collected.

Moving Through the Decontamination Corridor. Following removal of clothing, victims should be instructed to move rapidly to the water shower corridor and walk slowly through the corridor with their head back and arms and legs extended to expose the armpits and groin areas to the water shower. The hair on the head can collect vapor, liquid and solid contaminants. The tilting of the head is designed to prevent runoff from the head getting into the eyes or mouth of the victim. The armpits and groin areas must be exposed since they are particularly sensitive to chemical agent penetration. Victims should also be instructed to turn 90 degrees (1/4 turn) at least once to expose the front and back of the body to the cross stream.

Applying Gentle Friction to Increase Effectiveness of Decontamination. The application of gentle friction is recommended when the contamination involves chemical vapor, fine aerosols, or particles of biological or radiological contamination. Gentle friction includes rubbing with the hands or a soft cloth or sponges. Studies have shown this friction aids in the physical removal of contamination from the body. The use of brushes or other items that could break or damage the skin should never be used when performing mass casualty decontamination.

In the above situations, the contaminant should be wiped away from the body, starting with the head and moving down to the feet.

When the contamination involves liquid contamination, particularly oily agents such as mustard or nerve, the Working Group agreed that more harm than good could be caused by applying friction, especially without the use of an emulsifier such as soap. Applying friction by using the hands – the simplest and most expedient method in a mass decontamination situation – would transfer liquid contaminant to the hands and possibly result in the transfer of contamination to sensitive parts of the body such as the face, armpits and groin areas, thus increasing medical risk.

Providing Victims a Means of Clothing/Cover. Following decontamination, victims should be provided a means of clothing or cover, both to restore modesty and provide warmth. Common items employed by response agencies during response exercises include Tyvek® suits, blankets, sheets and large plastic garbage bags.

Tag Victims to Identify Decontamination Status. Decontaminated victims should be identified to aid medical personnel and others in determining potential risk to themselves when treating or assisting victims. Identification should include a method that can account for both initial mass decontamination and secondary decontamination. Some examples observed by the Working Group include the use of colored rubber bands and specially developed triage tags. Appendix G includes a report recommending the use of colored clothes pins.

Direct Victims to Treatment or Observation. Following decontamination, victims should be directed to medical treatment, observation or secondary decontamination as appropriate. Symptomatic victims should be directed to medical treatment and/or secondary decontamination. Non-symptomatic victims should be directed to an observation area.

5.0 Step 5: Post Decontamination

Step 5 describes the actions to be taken following completion of initial mass decontamination. This step includes observing victims for delayed symptoms and evidence of residual contamination; performing secondary decontamination as necessary; arranging for modesty wear for victims; recovering personal items; determining the need for follow-on care; and transporting victims to medical facilities as necessary.

5.1 Observation of Victims

The Working Group agreed that following mass decontamination there should be a period of observation to both verify the effectiveness of the decontamination and to watch for delayed symptoms of fast-acting chemical agents.

Observation for effectiveness of decontamination should include self, buddy, or responder evaluation to looking for physical signs of residual contamination. Involvement of a colorless chemical would make this type of observation difficult. However, since many agents would not be colorless, especially if they contain impurities as experts expect is likely for a terrorist attack, physical inspection may be effective in identifying residual contamination and the need for additional decontamination.

Observation is considered necessary to allow delayed symptoms of fast acting chemical agents to manifest while medical treatment is nearby. Small amounts of chemical agents, especially liquid agent on the skin, could result in delayed symptoms due to a delay in absorption of the agent into the body. Typically, there may be a latent period of one to 30 minutes and then a sudden cascade of overwhelming effects. One reported case of nerve agent poisoning resulted in an 18 hour delay before symptoms occurred. The Working Group does not recommend observing victims for such an extended period, but a reasonable minimum observation period should be determined based on the advice of medical personnel.

The observation period can also be used to disseminate information to victims on symptoms they should watch for after they are released and guidance on seeking follow-up medical care.

5.2 Secondary Decontamination

The need for secondary decontamination is most likely if an oily liquid based hazard (e.g., sulfur mustard) is involved and initial decontamination was performed with water only.

Though soapy water is ideal for all mass decontamination operations, it will likely be required for oily liquid agents in particular in order to provide the most effective physical removal of the agent from the victims' skin.

Medical facilities often require secondary decontamination before allowing contaminated victims inside the facility as an added precaution to protect medical staff and prevent the medical facility from being contaminated.

Appendix B: Discussion of Mass Decontamination

1.0 Basic Decontamination Discussion

This section provides a more detailed discussion of mass decontamination methods and procedures than is contained in Volume I and supports both the information contained in Volume I, as well as the discussion in *Appendix A: Discussion of Mass Casualty Decontamination Operations.*

There is insufficient data generated by sound scientific testing to fully validate the mass decontamination methods and procedures outlined in this Guideline. The methods and procedures described in this Guideline are the result of: 1) empirical evidence and expertise of doctors and scientific researchers from the U.S. Army Edgewood Chemical Biological Center and the U.S. Army Medical Research Institute for Chemical Defense and 2) the experience of responders from local communities and the U.S. Army's Aberdeen Proving Ground Fire Department.

Where it exists, data and/or the experience of the subject matter experts from animal testing and human testing were used to support the concepts described in this Guideline.

1.1 Definition of Decontamination

Decontamination refers to means that reduce the hazard of a contaminant. There are two basic methods of decontamination, physical removal and neutralization. Physical removal involves mechanical action with techniques such as wiping, blotting, and washing. Neutralization involves methods and/or materials to counteract the harmful effects of the contaminant. Physical removal and neutralization techniques may be used together to create an effective decontamination method.

The focus of these mass casualty decontamination Guidelines is on physical removal of the contaminant only. The addition of neutralizing agents, such as bleach, is likely to delay the conduct of mass decontamination and create potential additional hazards and safety issues when decontaminating large numbers of personnel.

For instance, the use of bleach to decontaminate victims creates three potential problems:

- **Delays administering the initial water shower.** Time is critical. Mixing diluted bleach or another neutralizing agent into the water shower, or providing it in buckets, could delay the start of the decontamination process.
- **Creates additional hazards.** Neutralizing agents applied during a mass decontamination water shower could get into the eyes, mouths or open wounds of victims, creating additional health hazards.
- **Increases agent penetration.** Neutralizing agents such as bleach can irritate and weaken or damage the skin, increasing the chemical agent's skin penetration.

1.2 Purposes of Decontamination

The three most important reasons for decontaminating exposed victims are:

- Remove the agent from the victim's skin and clothing, thereby reducing further potential agent exposure and further effects among victims.
- Protect emergency responders, medical personnel and others from secondary transfer exposures.
- Prevent victims from spreading contamination over additional areas.

Rapid physical removal of agent from the victim is the single most important action associated with effective decontamination. Physical removal includes disrobing, wiping, scraping or blotting visible agent from the skin and flushing or showering with large quantities of water.

Immediate disrobing is considered the single most critical step for victims. This simple step may remove 80% or more of the contamination.

For instance, after a chemical agent vapor or aerosol attack, toxic levels of agent may be trapped in victims clothes and hair, representing a continued threat to the victims themselves, fellow victims, first responders and medical personnel, and the public if victims are released without being decontaminated. This effect was demonstrated during the Tokyo sarin nerve agent attacks in 1995 where no decontamination of victims was performed. Numerous responders and medical personnel were affected by secondary exposure to the agent while treating victims.

Although medical staff in Tokyo suffered only minor effects from their secondary exposure to the contamination, it can take months to recover from a "minor" effect such as miosis (pupil constriction).

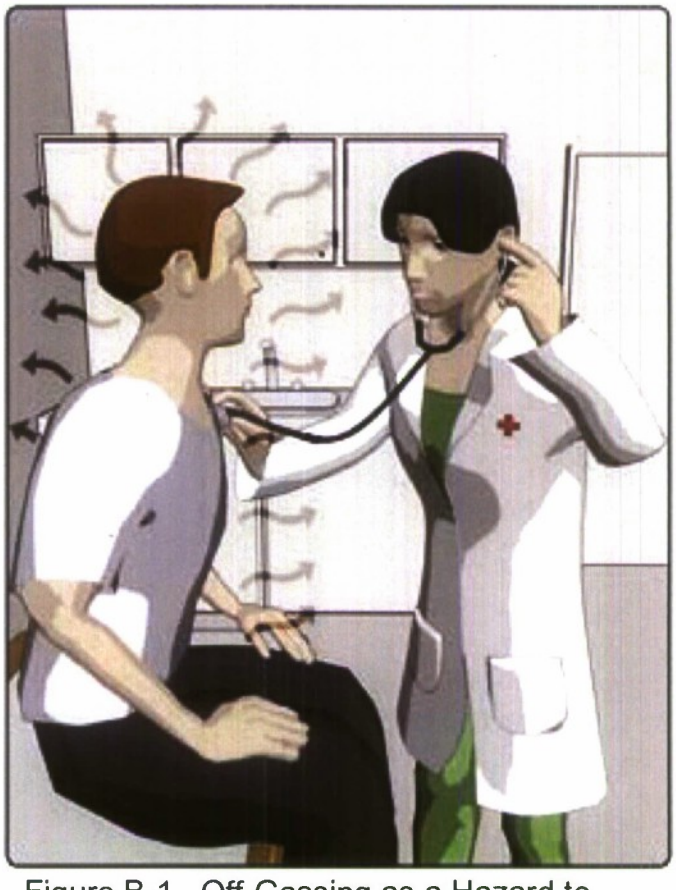

Figure B-1. Off-Gassing as a Hazard to Medical Staff

Removal of clothes alone may have significantly reduced secondary agent exposure. Application of a high-volume, low-pressure water shower could have eliminated residual hazard remaining in the victims' hair.

2.0 Methods of Mass Decontamination

Decontamination must be conducted as soon as possible to save lives, limit injuries and reduce the spread of contamination. This Guideline recommends that responders use resources that are immediately available and start decontamination as soon as possible. The consensus of the Working Group is that the most expedient approach, following removal of victims clothing, is to

use currently available equipment to provide an emergency high volume, low-pressure (approximately 60 pounds per square inch (psi)) water shower.

The following represent the forms of water-based decontamination:

- Water alone. Flushing or showering uses gravity and dilution to physically remove contamination from skin and hair. A water only shower is considered satisfactory for incidents involving chemical agent vapors, aerosols, radiological particles and biological particles.

- Soap and water. Adding soap can improve results by achieving ionic degradation of a chemical agent. Soap (or another emulsifier) aids in dissolving oily substances like blister and nerve agents. Liquid soaps are quicker to use than solids, and may reduce the need for gentle friction, however when rubbing with a sponge or cloth victims should be careful not to break or damage the skin.

  A soap and water deluge is best, in terms of effectiveness, for all HAZMAT/WMD incidents. *However, the consensus of the Working Group is that the removal of clothes and application of a water shower should never be delayed so that soap can be included in the initial water shower.*

- Bleach and water. Bleach (sodium hypochlorite) and water solutions remove, break down, and neutralize most chemical agents. However, as indicated above, this approach is not recommended in a mass decontamination situation where speed is the paramount consideration and victims are not trained in decontamination procedures.

  - Commercial bleach must be diluted and applied with equipment that may not be available to all responders.
  - Extensive skin contact time (up to 30 minutes) is required for effectiveness. This would also require additional steps to apply the bleach and then rinse the victims following the minimum contact time, resulting in delays in decontaminating large numbers of victims.
  - Laboratory studies suggest that bleach solutions at the 0.5% level may not be more effective than flushing with water alone. [A], [B]
  - Medically, bleach solutions are not recommended for use near eyes or mucous membranes, or for those with abdominal, thoracic or neural wounds. [C]

In summary, the issues associated with the use of soap or bleach solutions include time delay, dilution, specialized application, and medical contraindications. Given the satisfactory nature of

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[A] Hypochlorite Solution as a Decontaminant in Sulfur Mustard Contaminated Skin Defects in the Euthymic Hairless Guinea Pig; 1994; Gold, M.B., Woodard, Jr., C.L., Bongiovanni, R., Schraf, B.A., and Gresham, V.C.; Drug and Chemical Toxicology 17(4), 499-527.

[B] Evaluation of the Effects of Hypochlorite Solutions in the Decontamination of Wounds Exposed to Either the Organophosphonate Chemical Surety Material VX or to the Vesicant Chemical Surety Material HD (1992); Hobson, D.W. and Snider, T.H.; Final Report for Contract DAMD17-89-C-9050, Task 89-04; Battelle.

[C] Decontamination, Chapter 15 in Medical Aspects of Chemical and Biological Warfare; 1997; Hurst, Charles G.; in Textbook of Military Medicine, Part 1: Warfare, Weaponry, and the Casualty; Specialty editors: Sidell, F.R., Takafugi, E.T., and Franz, D.R.

water alone for all incidents except liquid chemical agent contamination, the rapid application of a water shower as described in Volume I provides an expedient, effective and broadly applicable method for mass casualty decontamination.

Only If responders are capable of applying a soap and water solution, without delay, does this method represent the better solution for all HAZMAT/WMD mass casualty decontamination situations.

3.0 Mass Decontamination for Specific Hazards

This section describes mass casualty decontamination for specific incidents, further explaining the reasoning behind the recommended procedures contained in these Guidelines.

3.1 Chemical Incident

Chemical agent incidents can include gross liquid, aerosol and vapor hazards. The threat of a chemical agent comes from direct absorption of the chemical through the skin, as well as inhalation of aerosols and vapors produced by the off-gassing of the chemical agents. In most cases, effects from chemical agents are immediate and observable and range from spasms and vomiting to dizziness, disorientation and death. Because effects are determined by dosage and proximity to the hazard, the effects may not be immediately apparent. In the case of mustard agents, though cell destruction begins upon contact, there will be no immediately visible effects or symptoms.

Therefore, do not assume that if a victim is walking and talking that he or she will not need decontamination. In the case of immediate acting chemical agents (e.g., nerve and blood agents, arsenicals), ambulatory victims may be of lower risk but should be encouraged to decontaminate. Decontamination is recommended as soon as possible to lessen chemical contamination effects. Immediate clothes removal and high-volume, low-pressure water are the recommended solutions. The more thorough the shower the better, though the addition of gentle friction will decrease throughputs and the length of the wash will depend on the responders' resources and the number of victims requiring decontamination. The recommended shower time is between 30 seconds to three minutes.

For vapor or aerosol contamination, the water only shower, combined with gentle rubbing with the hands, should effectively remove contamination from the skin and hair.

For gross liquid contamination with oily based chemical agents (e.g., VX nerve agent, sulfur mustard blister agent), mass decontamination with a water only shower may not remove all contamination from a victim's skin. At some point, application of soap and water to more effectively remove the contamination will probably be necessary. If a soap and water shower can be applied *without delaying the decontamination process*, then this is the preferred method. However, if application of soap will delay initial decontamination, then a water only shower should be applied immediately to remove gross contamination. In this situation an additional, more thorough secondary decontamination with soap and water should be applied as soon as possible to more effectively remove the oily agent.

In the case of oily agents, the Working Group also recommends that victims not rub during a water only shower. This recommendation is based on the potential for victims to spread the oily agent over a greater body surface area, increasing medical risk. For instance, mustard agent, which creates blisters on the skin, creates a hazard similar to thermal burns – i.e., the higher the percentage of the body covered in blisters, the greater the medical risk.

Mustard agent presents a particular problem when it comes to the application of friction. Mustard agent exposure results in both localized effects, such as blistering, and systemic effects. A large amount of agent left on the skin to absorb over time could increase systemic effects. However, just as with thermal burns, the higher the percentage of the body containing blisters from a mustard agent exposure, the greater the medical risk. As with thermal burns, blisters on 50-60% of the body can prove fatal. Since mustard agent is an oily substance, applying gentle friction, especially without soap, could cause victims to spread the agent over a larger percentage of their body and increase medical risk.

During application of soap and water to remove residual oily agent, if rubbing is necessary to completely remove the agent, it should be done carefully and localized as much as possible. Care must be taken to not break or damage the skin. Studies with animals have shown that damaging skin during decontamination may actually increase the absorption of contaminant into the body.

Note: The original Guidelines included the recommendation that if victims refused to remove their clothes that they should be sent through the water shower with clothes on. After further review, this procedure is not recommended, especially when liquid contamination is present, due to the increased risk of agent rapidly penetrating clothing and contacting the skin.

3.2 Biological Incident

Effects and symptoms of a biological attack will be delayed. In a biological incident, there likely will be no overt signs of a biological agent release and, therefore, no on-site decontamination. Treatment will likely occur at the hospital on an individual basis as symptoms arise in victims. In this scenario, hospitals and medical centers will be the center of the consequence management effort.

An overt biological release is most likely to involve a biological powder or slurry, or direct witness observation of a release of a biological aerosol.

In the event of an overt biological release, just as with a chemical agent incident, immediate clothes removal and high-volume, low-pressure water are still the recommended solutions to reduce exposure and the spread of contamination.

A high-volume, low-pressure shower that includes a soap-water solution is ideal for all situations, however, a water only shower combined with gentle friction, such as rubbing with the hands, is considered satisfactory for biological agents. Unlike chemical agents, biological agents will not penetrate unbroken skin, so there is no increased medical risk from applying gentle friction to more effectively remove biological particles from the hair and skin. In the event

victims have open wounds, care should be taken not to spread contamination into open wounds while rubbing.

Since biological agents do not produce immediate symptoms, once the presence of a biological hazard is confirmed victims can be released following decontamination and receipt of information on symptoms the victims should monitor for in themselves, family members, and others they may come in contact with, as well as follow-on care victims should seek should symptoms present themselves. This information can be disseminated at the observation area.

3.3 Radiological Incident.

Radiological contamination would likely consist of radioactive particles following an attack with a radiological dispersal device. Of all the HAZMAT/WMD hazards, radioactive contamination is easiest to detect with devices. Generally, radiological dispersal devices present a limited health hazard and do not cause immediate health effects. Therefore, if an incident is clearly identified as a radiological hazard only, responders should treat wounds first if equipped to do so, then decontaminate. The greatest risk during a radiological incident is inhalation of radioactive particles, so while the standard decontamination method is still beneficial, extra care should be taken to reduce forcing radioactive particles into the air. Victims should carefully follow the clothing removal process outlined in Volumes I and II.

Just as with biological contamination, a high-volume, low-pressure shower that includes a soap-water solution is best, but rapid decontamination using a water-only shower is satisfactory since radiological particles will not penetrate unbroken skin.

NOTE: The original Guidelines designated a slightly different process for biological and radiological decontamination that included decontaminating victims with a water shower prior to removal of clothes to prevent re-aerosolization of biological or radiological material. Subsequent evaluation indicates that the risk of re-aerosolization is minimal and that removal of clothes prior to decontamination with a water shower is still the most expedient means of decontamination.

Further, as explained in the original 2000 Guidelines, the Working Group was concerned that clothes might actually inhibit decontamination by trapping the contaminant inside sleeves, neck openings, shoes, or pant legs.

General Rules for HAZMAT/WMD Mass Decontamination

1 - Removing clothes is the single most critical step in mass decontamination and may remove 80-90% of physical contamination.
2 - Do not delay removal of clothes or application of a high-volume, low pressure water shower to set up tents, additional equipment or to create a soap-water solution. The water shower will dilute and remove contamination from the body.
3 –Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
4 - Wash time should be between 30 seconds and three minutes, depending on the situation.
5 - When the contamination **involves chemical vapors, biological or radiological material**, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of the contamination.
6 - Rubbing should start with the head and proceed down the body to the feet.
7 - Victim observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
8 - Secondary decontamination should be performed as necessary.

Special Considerations

Non-liquid
- If responders suspect the contamination is biological, radiological, or a gas/vapor, a water-only shower is typically adequate.

Liquid
- A secondary decontamination shower that includes a soap-water solution will likely be required for liquid contamination to ensure effective physical removal of agent.

When removing liquid chemical contamination (e.g., sulfur mustard), rubbing without the aid of soap is not recommended as it may increase spread of the agent over a larger surface area of the body, resulting in increased medical risk.

3.4 Cold Weather Mass Decontamination

3.4.1 Discussion of Cold Weather Decontamination Methods

Cold weather presents some additional challenges to performing mass decontamination. Victims may be less inclined to disrobe and the chances of cold weather injury are increased.

Still, the consensus of the Working Group is that even in cold weather, it is generally most practical to conduct decontamination outdoors. The healthy human body can withstand very low temperatures for a brief amount of time. *Regardless of the ambient temperature, people who have been exposed to hazardous contamination should disrobe, undergo decontamination and be sheltered as soon as possible.*

The recommended basic methods of decontamination (immediate clothes removal and high-volume, low-pressure shower) still apply for temperatures between 64°F and 36°F. Once the victims are decontaminated, they should be provided a means of clothing/cover and moved to heated facilities.

If decontamination triage is performed, an additional step can be taken to give a higher priority to the very young and elderly, as they are most likely to be effected by the cold weather. Within each mass decontamination priority category, all other criteria being equal (such as injuries/agent effects), additional priority can be given to the very young and elderly. For example, within the Ambulatory, Non-Symptomatic, Exposed category, the very young and elderly could be processed first to reduce the amount of time they are exposed to the cold weather.

Temperatures of 35°F and below present a special case, since at extreme low temperatures, the risk of mass cold weather injuries could exceed the risk presented by the HAZMAT/WMD hazard. At extremely low temperatures, the effectiveness of many chemical hazards is reduced, in some cases significantly. The risk from off-gassing from chemical agents is also significantly reduced.

Therefore, mass decontamination for chemical agents in extreme cold weather presents a dichotomy: The extreme cold presents a significant health hazard if victims face prolonged exposure. On the other hand, victims may be "safer" from the effects of the chemical hazard while outdoors. Moving victims indoors while fully clothed could significantly increase the danger from off-gassing as a result of the warmer indoor temperature and reduced gas dispersion from being in an enclosed space.

Biological agents are generally less affected by cold temperatures and radiological materials are not affected at all by the cold. Unlike chemical agents, neither biological nor radiological materials are subject to off-gassing. The mechanics of being infected by biological agent via inhalation/ingestion or subjected to radiological poisoning via inhalation/ingestion are likewise not impacted by cold weather.

Therefore, the consensus of the Working Group for extreme cold weather is to remove clothing outside and move victims inside as rapidly as possible. For biological and radiological hazards, and chemical vapor exposure, movement indoors after clothing removal, followed by a water shower is the recommended procedure.

In the unlikely event of a liquid chemical hazard in extreme cold weather, for victims with evidence of liquid contamination on their skin the Working Group recommends using a dry decontamination method after clothing removal, followed by movement indoors for a water shower.

Dry contamination should consist of using a paper towel or soft cloth to blot liquid contamination. Given the likelihood that victims would be wearing multiple layers of clothing in an extreme cold weather situation, inner layers of clothing may be used to blot the contamination. If inner layers of clothing must be used to expedite decontamination, clothing should first be quickly inspected for evidence of contamination.

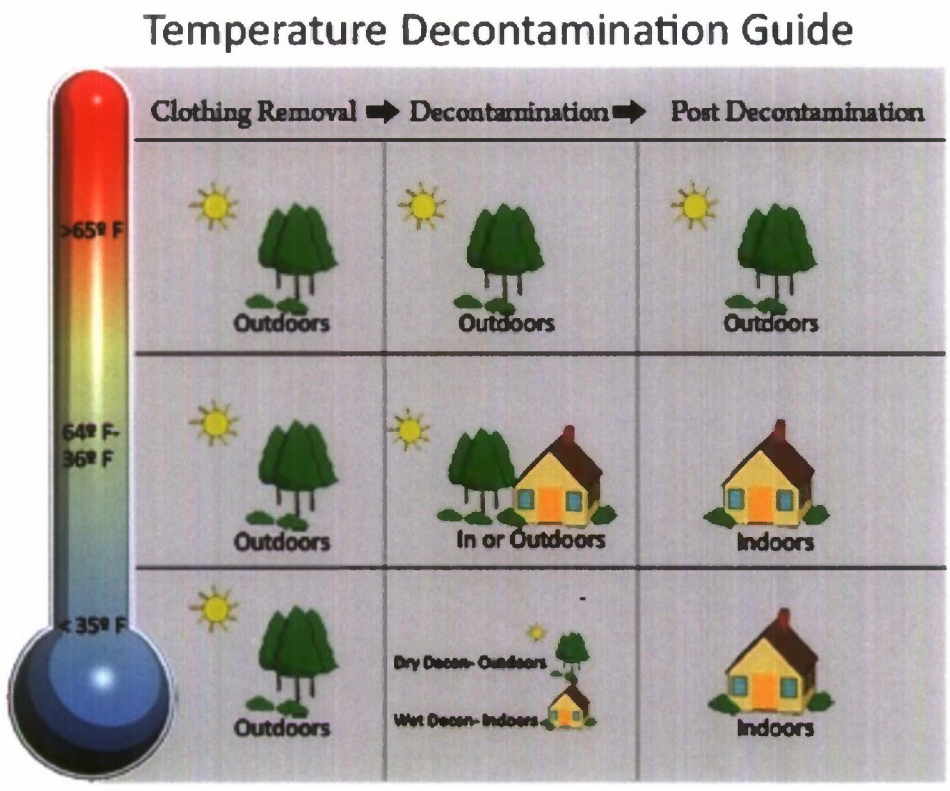

Figure B-2. Cold Weather Decontamination Guide

3.4.2 Cold Weather Hazard Information

Note: In a mass casualty decontamination situation in extreme cold, outdoor decontamination with water could create a greater hazard and result in more cold weather casualties than caused by the WMD hazard.

This section contains information that may be useful in assessing the on-scene situation in a cold environment.

- **Cold Shock.** Cold shock refers to the sudden onset of physical responses, such as an increase in blood pressure, triggered by cold-water exposure. This can result in sudden death in susceptible individuals. Cold shock occurs almost immediately and must be anticipated by the responder community. The risk of serious health implications from cold shock is greater for those with pre-existing medical conditions, such as heart disease, and among the elderly. There is tremendous variability in individual physical responses at specific temperatures. Cold shock is more likely to cause serious medical problems than hypothermia during mass decontamination operations. Cold shock can be minimized by inquiring about pre-existing medical conditions before decontamination, if the on-scene situation permits, and by encouraging people to gradually get wet, rather than being instantaneously deluged in cold water. This information on cold shock is

presented to help responders make informed decisions at the scene based on the competing risks of chemical exposure verses the decontamination process.

- **Hypothermia**. Although a genuine threat to inadequately protected individuals in some outdoor exposure situations, hypothermia is not a significant risk for most people undergoing mass decontamination in cold weather. Hypothermia is a condition of deep body cooling that usually takes longer to develop than one would normally encounter in a mass decontamination situation. Most individuals can tolerate 55°F water, and although they would shiver severely and experience great discomfort, they would not be in an immediate life-threatening situation due to hypothermia. For a wet individual in a cold environment, shivering is a sign that the body is trying to warm itself and is not necessarily of significant concern. If an individual is cold and wet and is not shivering, prompt medical attention should be sought since some people are not able to shiver and are at greater risk of developing hypothermia.

- **Cold Weather Physiology.** Humans must keep a near-constant body temperature regardless of environmental temperature. Humans can distinguish slight temperature differences of 0.5°F, are negatively impacted at a 2°F difference, and cannot function effectively at 7°F from their normal core temperature of 98.6°F (37°C). Because of this, humans must maintain their core temperatures within a narrow range. Since human bodies constantly produce heat, there are four highly developed mechanisms for releasing heat to the environment:

    - Evaporation – transition of a liquid to vapor with resultant heat loss
    - Conduction – heat exchange between two objects in direct contact
    - Convection – heat gain or loss to air or water moving over the body surface
    - Radiation – heat exchange between two objects not in direct contact

    Most people are unaware of all four heat transfer mechanisms. Evaporation occurs during processes such as perspiration and respiration. The evaporation of water during respiration allows people to "see" their breath when the environment is cold. Conductive heat loss occurs, for example, when a warm hand is placed on a cold object, and eventually the hand becomes cold. Convective heat loss occurs when, for example, a breeze passes a warm face, replacing the layer of warm air next to the skin with cold air. Radiative heat loss occurs when the environment is colder than the uncovered surface of the body. In these transfer mechanisms, it is the difference in temperature between the body and the environment that results in heat gain or loss.

    Conversely, the human body has three physiological ways of maintaining and producing heat: resting (quiescent body state) metabolism, exercise, and shivering (the involuntary contraction of muscles). Resting metabolism (conversion of food stores to energy) produces heat as a by-product during rest. Exercise is an obvious voluntary method of producing heat; to warm up, a person might do jumping jacks, run in place, or walk around for short periods of time. However, if individuals have no means of sustaining exercise, shivering becomes the main source of heat for people who are exposed to cold for long periods of time. Shivering can potentially generate five times the amount of heat normally produced by the resting metabolic rate.

Shivering, increased activity, and behavioral responses such as adding clothing are simple ways for an individual to maintain body temperature. More complex, physiological responses are vasoconstriction (decreased blood flow) and vasodilation (increased blood flow) when the body is cooled or warmed, respectively. Because the blood from a person's core is cooled as it flows through the periphery (hands, feet, arms, and legs), vasoconstriction minimizes this avenue of heat loss and helps the body to conserve heat in a cold environment.

Mild hypothermia is characterized by normal shivering, and the person is likely to report the sensation of being cold. Goosebumps may appear on the surface of the skin, and some people may be unable to perform simple or complex tasks with their hands, such as fastening a button.

People suffering from **moderate** hypothermia may be ill-tempered and/or slow moving. They may stumble when on their feet, fumble with their hands, mumble, slur their speech, and shiver more intensely. Shivering stops at about 86°F (30°C) core temperature. A person with moderate hypothermia will have difficulty with higher cognitive functioning, may be more difficult to manage in a group setting, and may act inappropriately.

Severe hypothermia is characterized by a lack of shivering, unresponsiveness, pupil dilation, and cloudy consciousness. The person may be unable to walk or move his/her arms and legs and may curl up into a fetal position. If untreated, a healthy adult with severe hypothermia can progress to respiratory failure, cardiac arrest, and death.

Suspected hypothermic patient must be carefully assessed for coexisting injuries and illnesses (e.g., diabetic seizure). First responders should be aware of these physiological and mental symptoms when monitoring victims with suspected cold injury. Most of the guidelines offered in this Guideline are based on core temperatures; however, it may not be practical to measure the core temperature of chemical agent victims. The simplest assessment a first responder might perform to determine a potential cold stress injury in a decontaminated individual is to place an ungloved hand on the skin of the patient's chest or back. If the skin feels warm, then hypothermia is unlikely. This method of assessment can be used if responders are not able to take the victim's temperature with a thermometer. A hypothermia assessment thermometer should read as low as 70°F in order to accurately measure low core temperatures. Figure B-3 lists stages and symptoms of hypothermia.

	Core Temperature		
Stage	**°F**	**°C**	**Physiological Changes**
Normothermia	98.6	37.0	
Mild Hypothermia	95.0	35.0	Maximal shivering, increased blood pressure
	93.2	34.0	Amnesia; dysarthria (trouble speaking); poor judgment; behavior change
	91.4	33.0	Ataxia (lack of coordination); apathy
Moderate Hypothermia	89.6	32.0	Stupor
	87.8	31.0	Shivering ceases; pupils dilate
	85.2	30.0	Cardiac arrhythmias; decreased cardiac output
	85.2	29.0	Unconsciousness
Severe Hypothermia	82.4	28.0	Ventricular fibrillation likely; hypoventilation
	80.6	27.0	Loss of reflexes and voluntary motion
	78.8	26.0	Acid-base disturbances; no response to pain
	77.0	25.0	Reduced cerebral blood flow
	75.2	24.0	Hypotension (low blood pressure); bradycardia (low heart rate); pulmonary edema
	73.4	23.0	No corneal reflexes; areflexia (lack of neurologic reflexes)
	66.2	19.0	Electroencephalographic silence
	64.4	18.0	Asystole (no cardiac electrical activity)
	59.2	15.2	Lowest infant survival from accidental hypothermia
	56.7	13.7	Lowest adult survival from accidental hypothermia

Figure B-3. Stages and Symptoms of Hypothermia

3.4.3 Wind Chill

A wind chill estimate or temperature is an attempt to quantify the effect of moving a cold air stream over a warm body. In effect, this air movement displaces the warm air at the body surface and replaces it with a layer of air at ambient temperature. The amount of heat loss is therefore a function of both air temperature and wind speed. If the body surface is wet, then heat loss is magnified by evaporation. People who already may be wet from decontamination will experience greater discomfort during cold exposure and their body temperature will cool faster than an individual with dry skin. For the purposes of cold weather mass decontamination, responders should be aware of an increased risk of cold shock and hypothermia when wind is present.

Figure B-4 on the next page depicts risk of frostbite, based on time, for various temperatures and wind speeds.

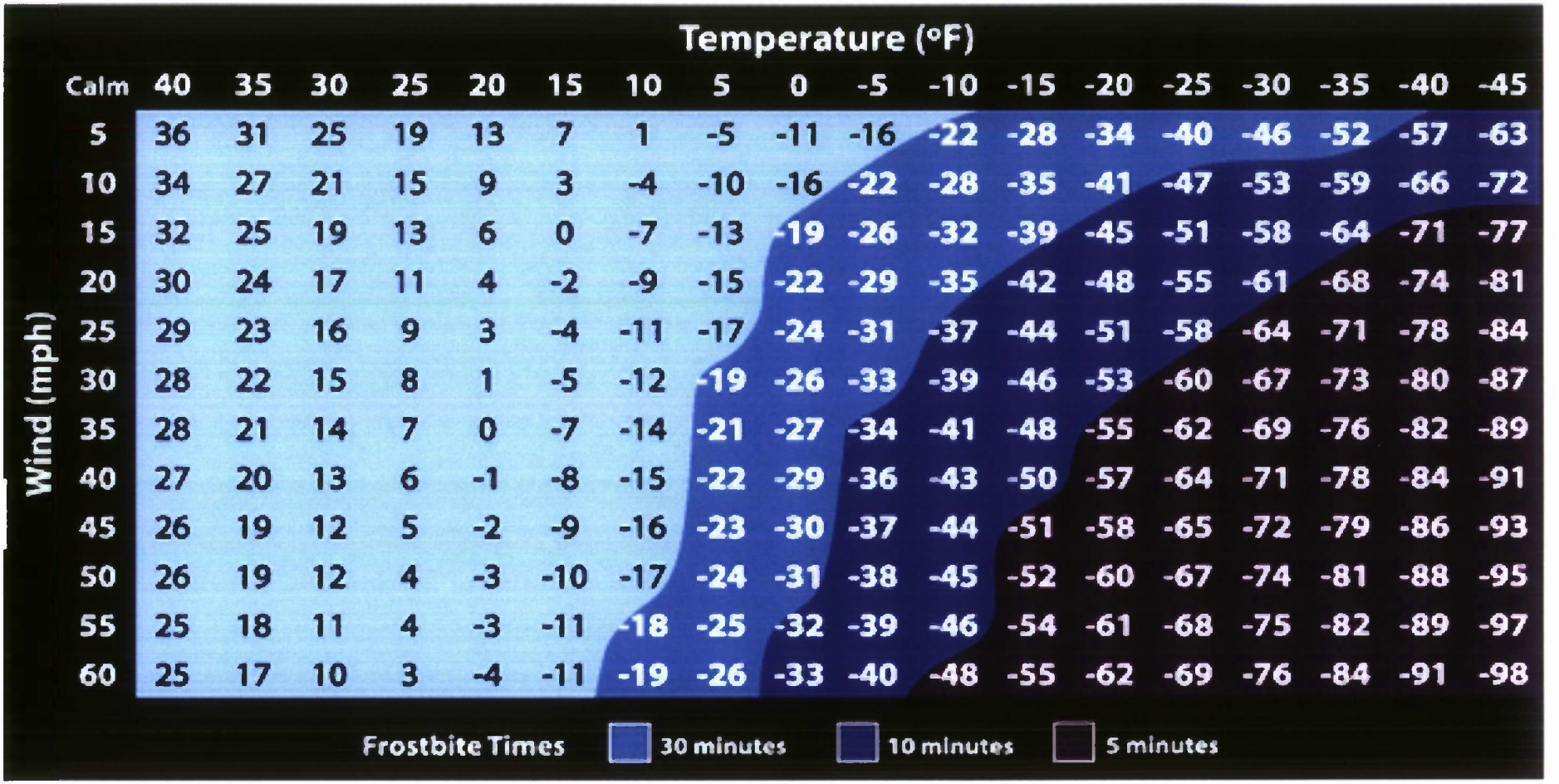

Figure B-4. Frostbite Risk by Temperature

Appendix C: Chemical, Biological and Radiological Agent Information

The section briefly discussed the properties, symptoms and behaviors of CBR warfare agents. It is intended to be a quick technical reference guide.

1.0 Chemical Agents

1.1 Properties

- Chemicals are usually found in liquid form, producing both a contact hazard with the skin and toxic vapors.
- Most existing chemical weapons are either nerve or blister agent weapons and terrorist organizations have attempted to either manufacture or acquire these agents.
- Nerve agents attack the nervous system through skin contact, inhalation or ingestion.
- Blister agents cause skin blisters, as well as systemic effects.
- Symptoms can be caused by contact with the liquid or, in very high concentrations, from vapors and from inhalation of vapors.

1.2 Symptoms:

- Symptoms of a chemical attack may be almost immediate (nerve agents), or they may be delayed for hours to days (mustard agents).
- Nerve agents:
    - Miosis: Contracting of the pupils. Rapid effect that becomes more acute over time
    - Headache
    - Twitching of eyelids
    - Blurred vision
    - Runny nose
    - Vomiting
    - Weakness
    - Muscle twitches
    - Tightness in chest
    - Convulsions
    - Loss of consciousness
    - Death will usually occur in less than 15 minutes after a lethal exposure to a nerve agent
- Blister agents:
    - May have significantly delayed symptoms, with latent periods for hours after exposure, especially in the case of mustard agents.
    - Irritation of the skin, which may lead to severe pain.
    - Formation of blisters, which are very sensitive to infection.
    - Irritation of the throat, which may lead to pain and blisters.
    - Cough.
    - Death can occur within a few days from either asphyxia, pulmonary edema, or bacterial infection.

2.0 Biological Agents:

2.1 Properties:

- Biological weapons can be disseminated in many ways, but the most common and likely way is to aerosolize them.
- Biological weapons may cause illness that is contagious or non-contagious.
- The intent of biological weapons may vary, from causing illness of a small group of people to causing death on a large scale.
- Biological weapons are usually bacteria or viruses found in nature.

2.2 Symptoms:

- Symptoms from a biological attack are not usually immediate, taking days to become observable or severe. However, some toxins may produce effects within a much shorter period of time.
- Symptoms are unique for different biological agents. However, typical initial symptoms include cold- and flu-like symptoms, making it difficult to quickly diagnose.

3.0 Radiological Agents:

3.1 Properties:

- Radiological weapons would typically be radiological dispersal devices (RDDs) or "dirty bombs," such as radiological material from medical equipment or waste dispersed by a conventional explosion.
- The greatest danger from radiological weapons is posed by inhalation of radioactive particles.

3.2 Symptoms:

- Symptoms are delayed for hours, days, or longer depending on the dose
- Symptoms appear in several stages. There is an initial stage of illness, followed by a latent period, then a final stage of illness.
- The initial stage is characterized by nausea and vomiting, though this is not seen in all cases, even when contamination has been significant.
- Symptoms of the final stage vary with degree of contamination, but include low white blood cell count, hair loss, diarrhea, fever and death.
- Final symptoms do not present until days to weeks after exposure.

Chemical Agent Technical Information Table

Agent	VX (nerve)	GD (nerve)	HD (blister)
Health Hazard Data	• >25-30 mg-min/m^3 of vapor is lethal • >10mg of liquid is lethal	• >70 mg-min/m^3 of vapor is lethal • >0.35g of liquid is lethal	• Median dose is 2000 mg-min/m^3 of vapor on skin. • Median dose is 1500 mg-min/m^3 of inhalation.
Special Protection and Precautions	• Protective suit with SCBA.	• Protective suit with SCBA.	• Protective suit with SCBA
Spill Procedures/Waste Disposal	• Alcoholic HTH is neutralizing agent.	• Sodium hydroxide is neutralizing agent.	• 5.25% sodium hypochlorite is neutralizing agent.
Reactivity Data	• Relatively stable at room temperature • Hydrolysis creates EA2192, a weaker poison.	• Stable storage in steel.	• Stable at ambient temperature • Hydrolysis creates HCl and thiodiglycol
Physical Data	• Liquid at -50°C to 298°C. • Colorless to straw colored.	• Liquid from -42°C to 198°C • Colorless to dark brown with fruity odor.	• Colorless to dark yellow. • Garlicky odor. • Liquid at room temperature.

Biological Agent Technical Information Table

Agent	Anthrax	Smallpox	Plague
Disinfection	• Survives in many conditions and resistant to disinfectant. • Glutaraldehyde to disinfect.	• Survives longer in cold temperatures. • Survives in clothes and linens. • 1% sodium hypochlorite to disinfect.	• 1% sodium hypochlorite to disinfect.
Transmission	• Inhalation • Skin contact • Ingestion	• Inhalation	• Inhalation • Spread by fleas
Treatment	• Susceptible to penicillin.	• None except a vaccine.	• Susceptible to streptomycin.
Health Hazards	• 8,000 to 50,000 organisms to be infectious. • Higher fatality rate for inhalation.	• 30% fatality rate.	• Pneumonic is more fatal (nearly 100% if untreated) than bubonic (50% fatality).
Protection and Precautions	• Protective equipment with respirator.	• Protective equipment with respirator.	• Avoid creating aerosols. • Protective equipment with respirator.
Communicability	• Person to person transmission is very rare.	• Highly communicable.	• Pneumonic plague is highly communicable

Appendix D: Supplemental Topics for Consideration

This section provides additional information and describes equipment beyond the basic set of solutions to enhance decontamination capability and effectiveness. These ideas require more manpower, pre-planning and resources and may not be applicable to all organizations and localities. These ideas should not supplant the basic solution of clothes removal and high-volume, low-pressure water shower.

1.0 Preparing for Response and Mass Decontamination for a HAZMAT/WMD Incident

1.1 Training

Few terrorist or naturally occurring events require mass casualty decontamination, thus very little real-world experience has been accumulated. For example, mass decontamination was not performed following the sarin nerve agent attacks in Tokyo. Although the objective of this Guideline was to develop a simple, repeatable process, successful conduct of mass decontamination requires individual training to master individual tasks; team training to master each of the five decontamination steps; and integrated, collective training to ensure a fast, effective, coordinated response and mass decontamination operation.

1.2 Community outreach

Clothing removal and washing as soon as possible are vital to mass decontamination. In most cases, first responders will not be at the scene until five to 10 minutes after the event, losing critical time. If the community is aware of the following basic steps, they can assist with saving lives.

- Conduct decontamination training for local security forces such as mall or stadium security.
- Train 911 operators to instruct callers on basic decontamination in the event of a HAZMAT/WMD event.
- Post basic decontamination steps on community websites to increase public awareness.

1.3 Memorandums of Agreement (MOA) and Memorandums of Understanding (MOU)

MOAs/MOUs should be established with other organizations (e.g., hospitals, HAZMAT responders, emergency medical services (EMS), law enforcement) to supplement capability during a mass decontamination situation. The MOA/MOU should identify the relationship, the type and level of support, instructions, and contact information. The MOA/MOU should be updated regularly.

1.4 Target Assessment

Identify areas at high risk for HAZMAT/WMD attack (e.g., sports arenas, shopping malls). Determine feasible support from other jurisdictions for these areas. For high risk targets, determine potential sites for conducting mass decontamination, setting up observation areas, and establishing a secondary decontamination site should it be needed.

1.5 Route Assessment

Determine routes to and from potential incident sites to assist in determining the flow of resources to possible decontamination sites. Consider traffic patterns and potential congestion points and inform local responders and resources of the most efficient routes in advance.

1.6 Medical Facilities

Identify local hospitals' and medical facilities' capacity to handle mass casualty situations. Identify medical facilities (e.g., hospitals, clinics) near likely targets so they can be quickly informed and supported during an actual incident. Determine if local and mutual aid medical facilities will require victims to undergo secondary decontamination prior to allowing them to the facility. If so, determine whether the medical facility will perform the secondary decontamination themselves or whether they will require support to perform the secondary decontamination.

2.0 Technology, Techniques, and Equipment

2.1 Secondary Decontamination

Secondary decontamination refers to the set up of an additional site(s) to conduct further decontamination, typically with soap or another emulsifier.

Equipment such as decontamination tents, showers and the use of additives such as soap, are best implemented at the secondary decontamination site. If physical assets are limited, one possible method of secondary decontamination is re-running victims through the initial decontamination site, but at a slower and more deliberate pace that emphasizes thorough cleaning and removal of all residual agents. Liquid soap, if available, should be distributed for victims' use.

Many medical facilities will require a more thorough, secondary decontamination prior to treating victims and/or allowing them inside the medical facility for treatment. Many medical facilities take this added precaution to reduce the risk to medical staff, as well as to avoid contaminating the medical facility itself, which could impact both the emergency response effort as well as non-emergency medical facility operations.

2.2 Reactive Skin Decontamination Lotion

Reactive skin decontamination lotion (RSDL) is a new commercially-available personnel decontamination lotion that is highly effective against chemical agents. It is relatively expensive when compared to the cost of soap and may be difficult to use with a large number of victims. If RSDL is to be used, provide it as soon as possible for spot decontamination of visible contamination. Blot the RSDL on the agent droplet to begin agent neutralization start reaction and removal.

2.3 Bleach

Not recommended for victim decontamination.

2.4 Soap

Adding soap to the water for decontamination is slightly more effective for removing contamination from a victim's skin, particularly if the contamination is oily. Do not delay decontamination to incorporate soap if it is not readily available, pre-mixed or easily implemented. When using soap, a liquid form that can be quickly and easily incorporated into the process is recommended.

2.5 Sanitizing Wipes

If readily available, sanitizing wipes can be used to remove liquid and solid contamination from the skin. Sanitizing wipes can be particularly effective for use during secondary decontamination or for cold weather decontamination.

2.6 Decontamination Tents

While sometimes useful as a secondary decontamination site, or as a means to provide some privacy for victims, most mass casualty decontamination situations cannot afford the time required to set up tents, even for secondary decontamination. Although tents provide the benefit of modesty protection, they do so at the expense of valuable time. In addition, most commercial decontamination tents do not provide either sufficient volume or pressure to effectively remove contamination from a victim's skin.

3.0 Crowd Control/Comfort

3.1 Personal Items

Returning personal items is a laudable goal, but should not obstruct performing immediate mass decontamination to save lives and limit casualties. Plastic bags can be used to store personal effects. Instructing victims to place/tag their own items in bags will help prevent cross-contamination and aid responders. Do not return belongings to victims until the belongings have been decontaminated or deemed safe.

3.2 Crowd Control

Exercises have demonstrated that effective crowd control is critical to initiating rapid mass decontamination. The use of public address systems or other means of voice amplification, as well as universal signage to direct victims can be effective means of communication with victims following a HAZMAT/WMD incident.

3.3 Emergency Responder Protection

Law enforcement will maintain order and prevent disruptions to emergency operations. They should be aware of and look for secondary devices and other suspicious activities. Law enforcement can also help maintain crowd control around the decontamination site/response area. Law enforcement personnel without appropriate protective equipment must perform their responsibilities from the cold zone.

3.4 Modesty Clothing

Modesty clothing/cover should be provided if available. Do not delay decontamination to acquire clothing. Those who do not wish to disrobe and who display no symptoms should be separated and placed under observation. However, they should be made aware that liquid chemical agent contamination will eventually penetrate their clothing and that immediate removal of clothing and decontamination is the safest alternative. They should also be made aware that their clothes and hair may have trapped solid, aerosol or vapor contaminants and that they eventually may be affected by the contaminant if they are not decontaminated.

3.5 Contaminated Animals

If possible, animals should be secured in an area within the warm zone and decontaminated after humans in order to prevent further spread of contamination. Since an animal's typical reaction to a water shower is to shake violently to remove the excess water, animals should be decontaminated in the warm zone to prevent the possibility of spraying contamination on victims, responders or other animals.

4.0 Alternate Sites

4.1 Alternate Sites Definition

Alternate sites refer to decontamination outside the incident zone, such as secondary decontamination established at medical facilities.

4.2 Time Factor

Consider the time and resources required to move victims to an alternate site. Time should be the number one factor when determining whether to establish an alternate site. Rapid decontamination at the incident site should not be sacrificed to move victims to an alternate site.

4.3 Alternate Site Selection

Alternate sites should have a readily available water supply, such as a sprinkler system, shower, swimming pool, or support from local/mutual aid response organizations.

5.0 Environmental Concerns

The Environmental Protection Agency (EPA) addressed the issues of acceptable levels of contamination in runoff and first responder liability for the spread of contamination caused by efforts to save lives.

5.1 Liability

The EPA's interpretation of The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) indicates that *"no person shall be liable…for costs or damages as a result of actions taken or omitted in the course of rendering care, assistance or advice in*

accordance with the National Contingency Plan (NCP) or at the direction of an On-Scene Coordinator appointed under such plan…"

5.2 Runoff

On the subject of accepted runoff, the EPA recognizes that any level of contamination represents a threat to the environment. The threat is also dependent on many variables, including the chemicals involved, their concentrations, and the runoff watershed. However, life and health considerations are paramount. *"First responders should undertake any necessary emergency actions to save lives and protect the public and themselves. Once any imminent threats to human health and lives are addressed, first responders should immediately take all reasonable efforts to contain the contamination and avoid or mitigate environmental consequences."* The EPA allows that the highest priority be given to responder actions taken to save lives and preserve health during a chemical terrorist incident. The EPA indicates that, when taking federally recommended actions in response to a chemical terrorist incident, responders are protected under the law.

6.0 Legal Concerns

Lawsuits have been filed against responders and communities following decontamination operations where privacy was not provided during decontamination. Although these lawsuits did not involve mass decontamination, it is impossible to rule out the possibility of lawsuits following a mass decontamination operation. Lawsuits can be filed for any number of reasons related to mass decontamination, to include lack of privacy, unnecessary decontamination, loss of personal property, and inadequate decontamination.

Ultimately, each jurisdiction must base their policies on local interpretation of applicable regulations, statutes, laws and historical legal precedence.

Appendix E: Drawings and Diagrams

This section contains large scale versions of all the mass decontamination drawings and diagrams.

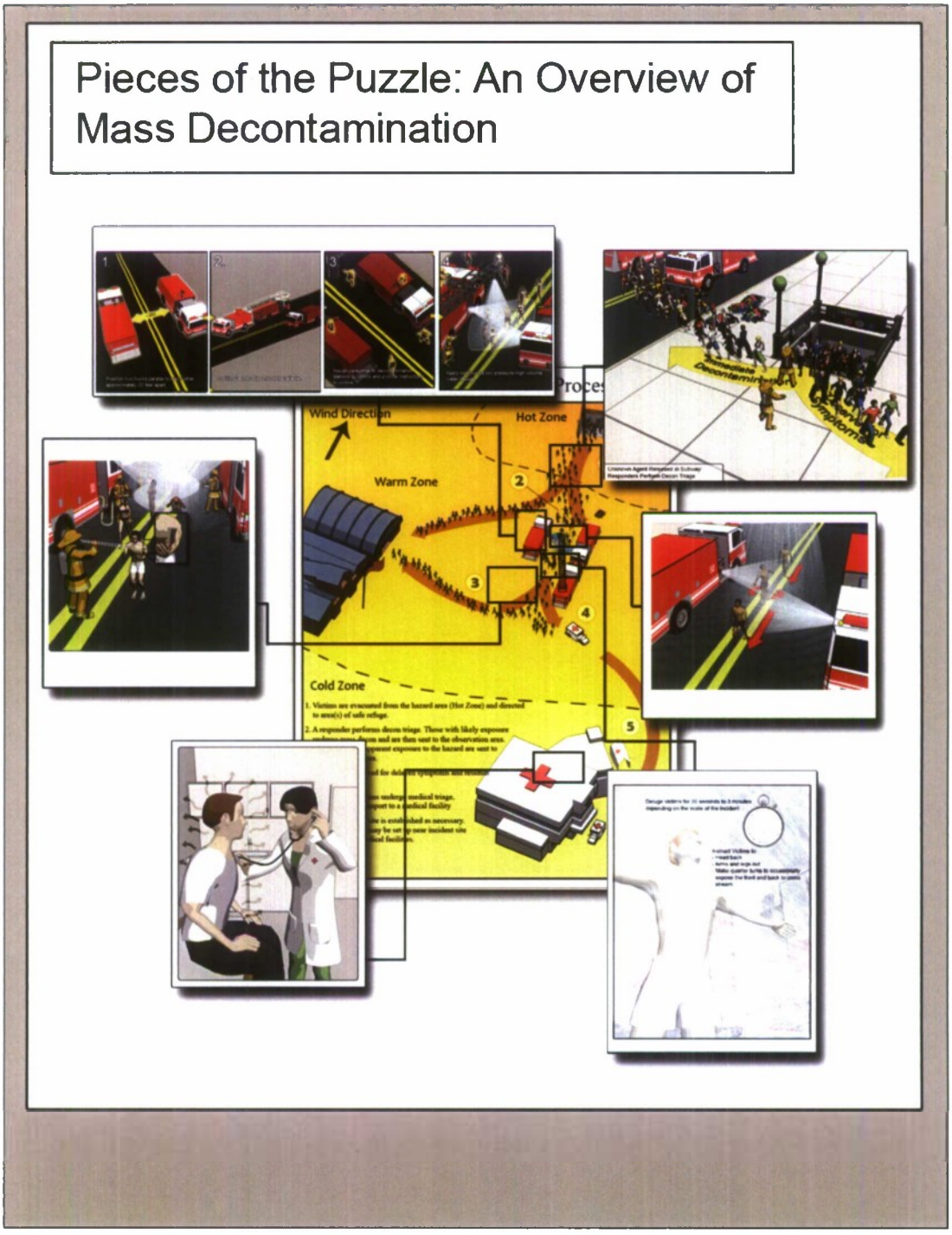

Figure E-1. Mass Decontamination Overview

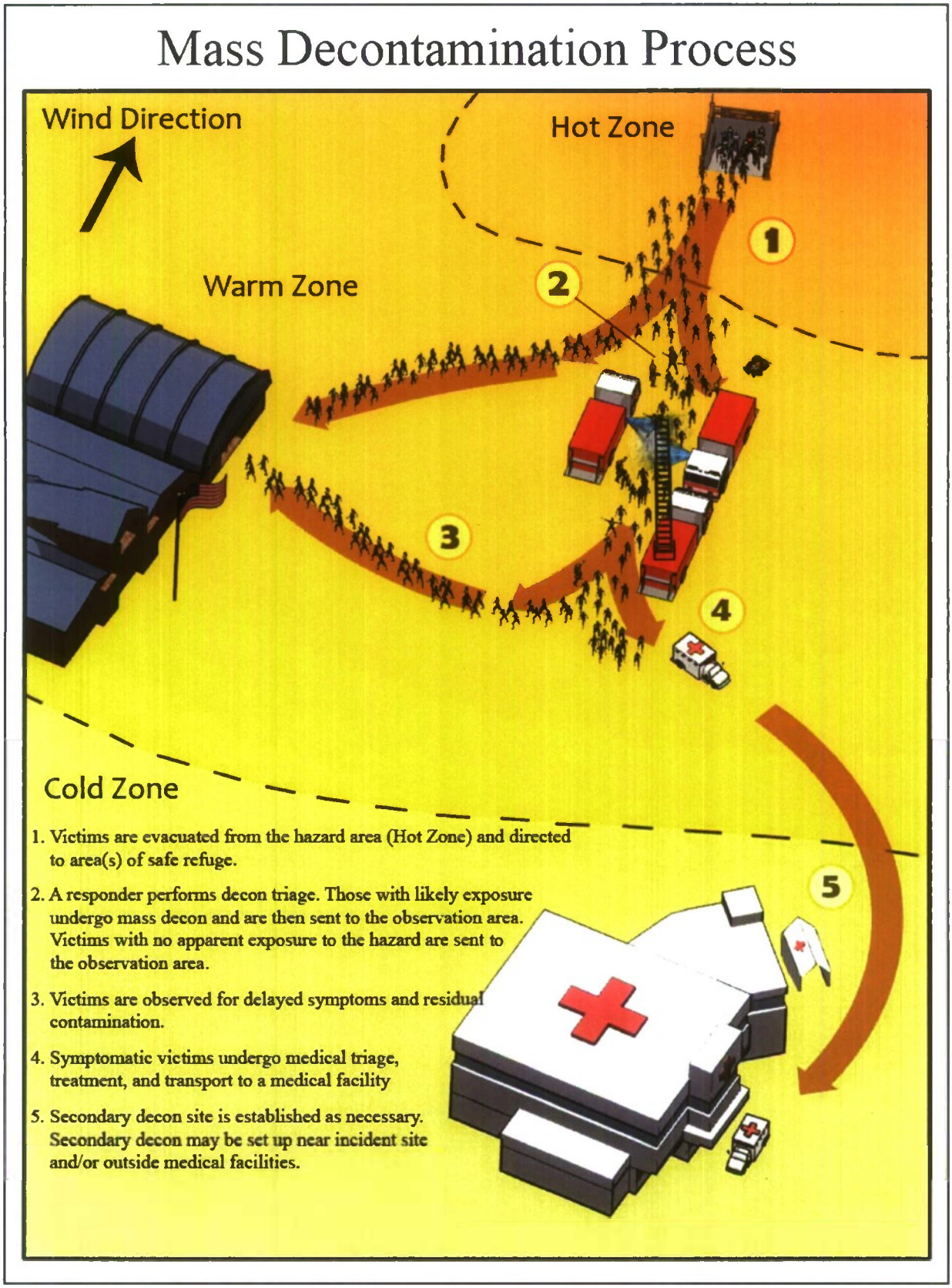

Figure E-2. Mass Decontamination Process

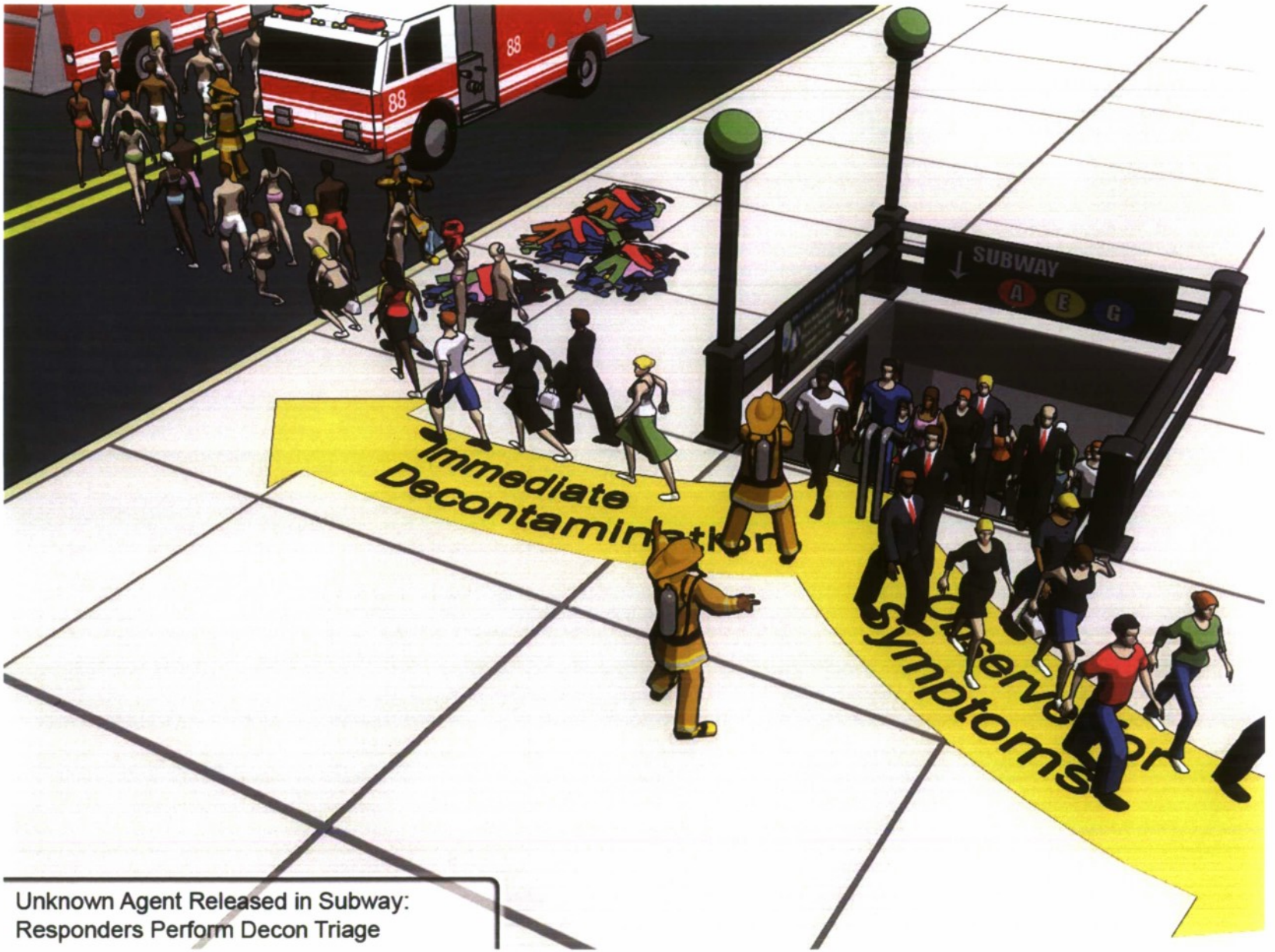

Figure E-3. Mass Decontamination Triage

Figure E-4. Mass Casualty Decontamination Triage Decision Tree

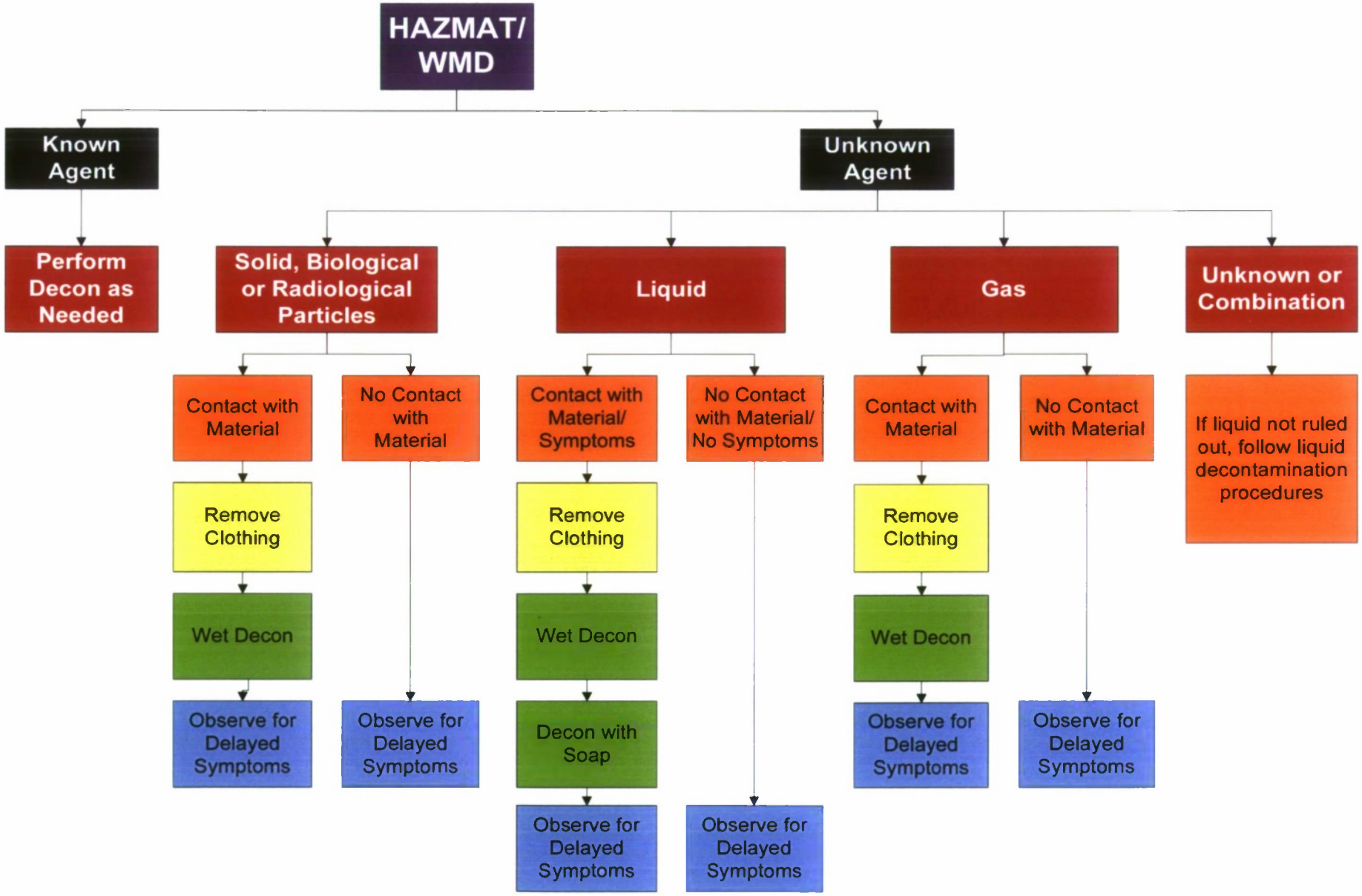

Figure E-5. Proper Removal of Clothing

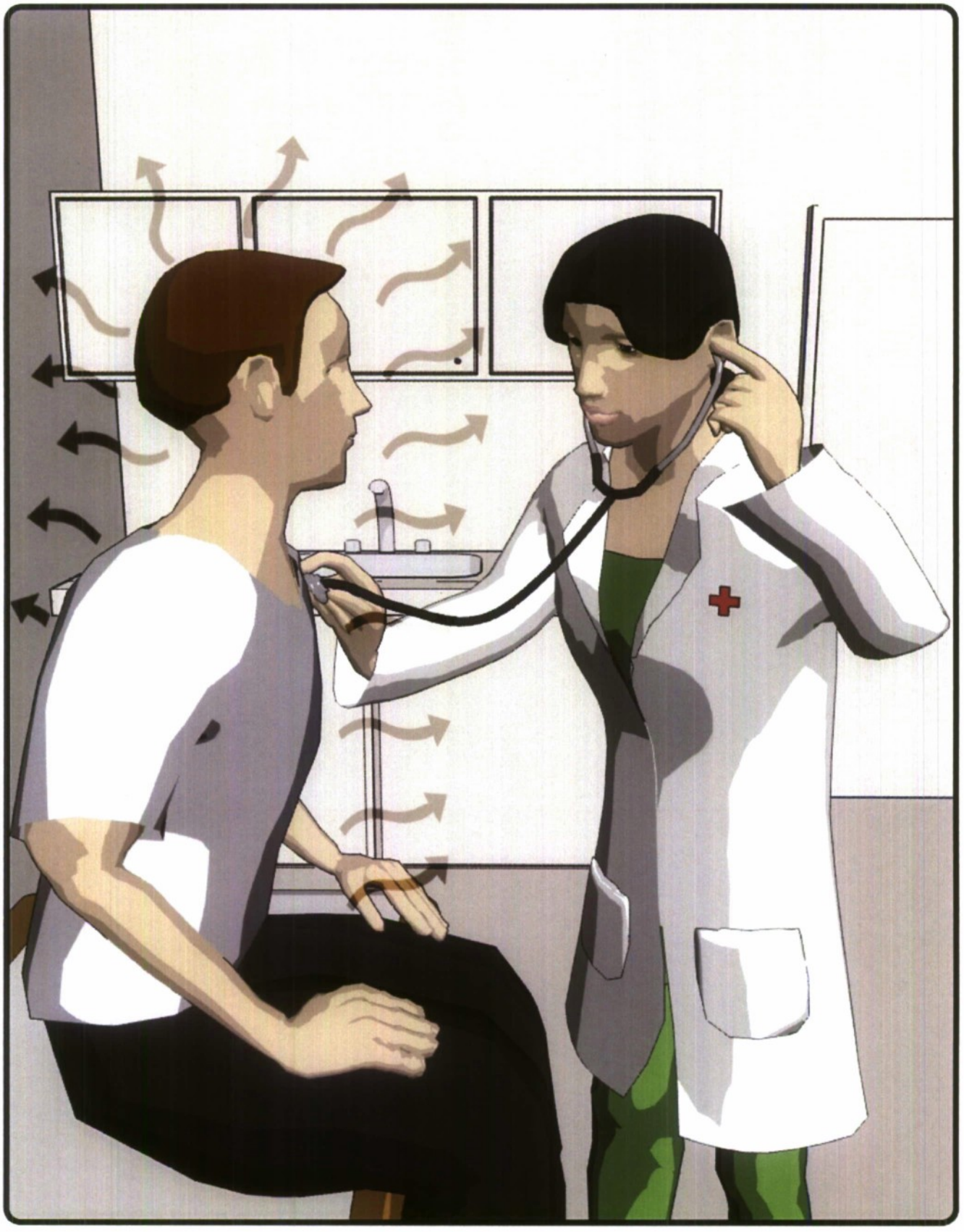

Figure E-6. Off-Gassing Hazard

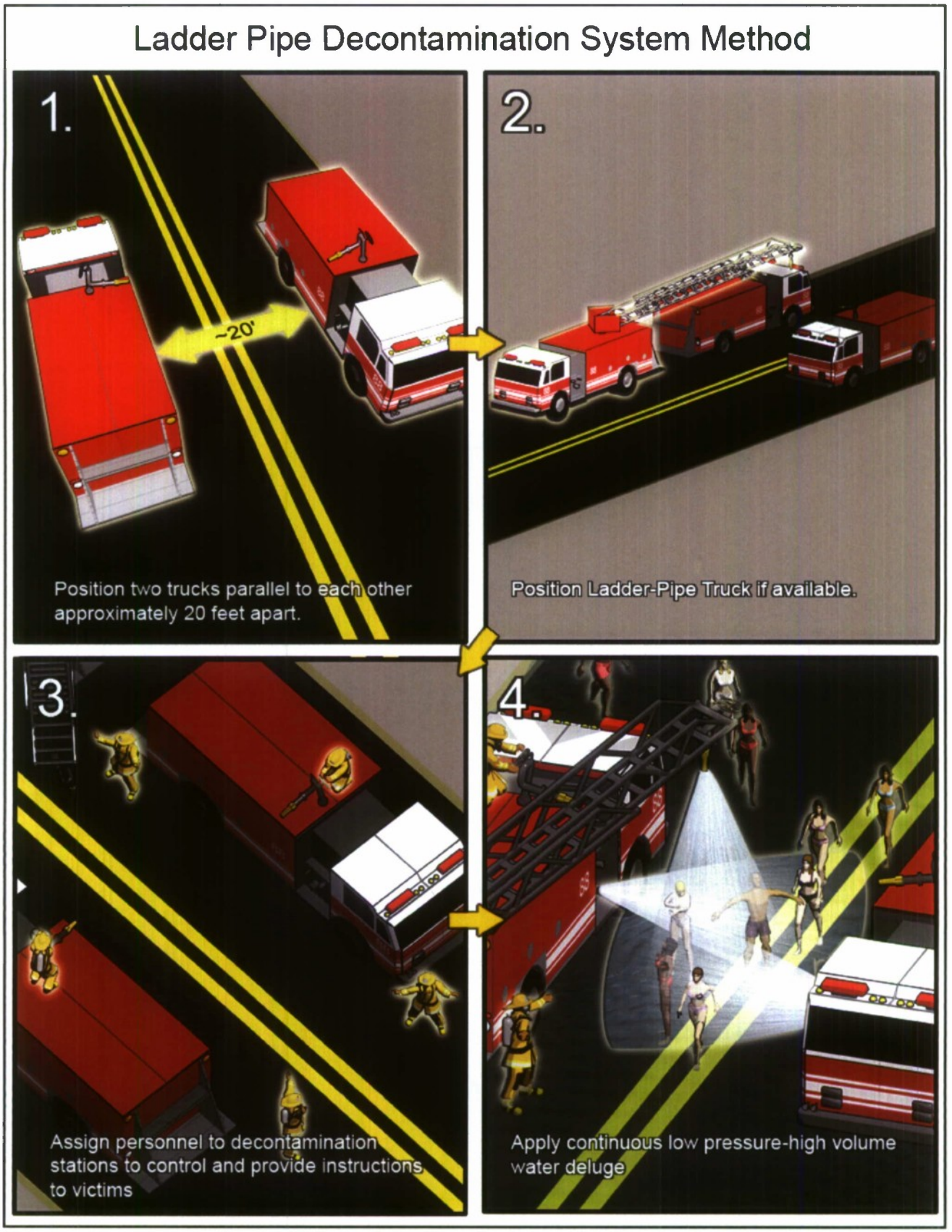

Figure E-7. Ladder Pipe Decontamination System

Figure E-8. Mass Decontamination Corridor

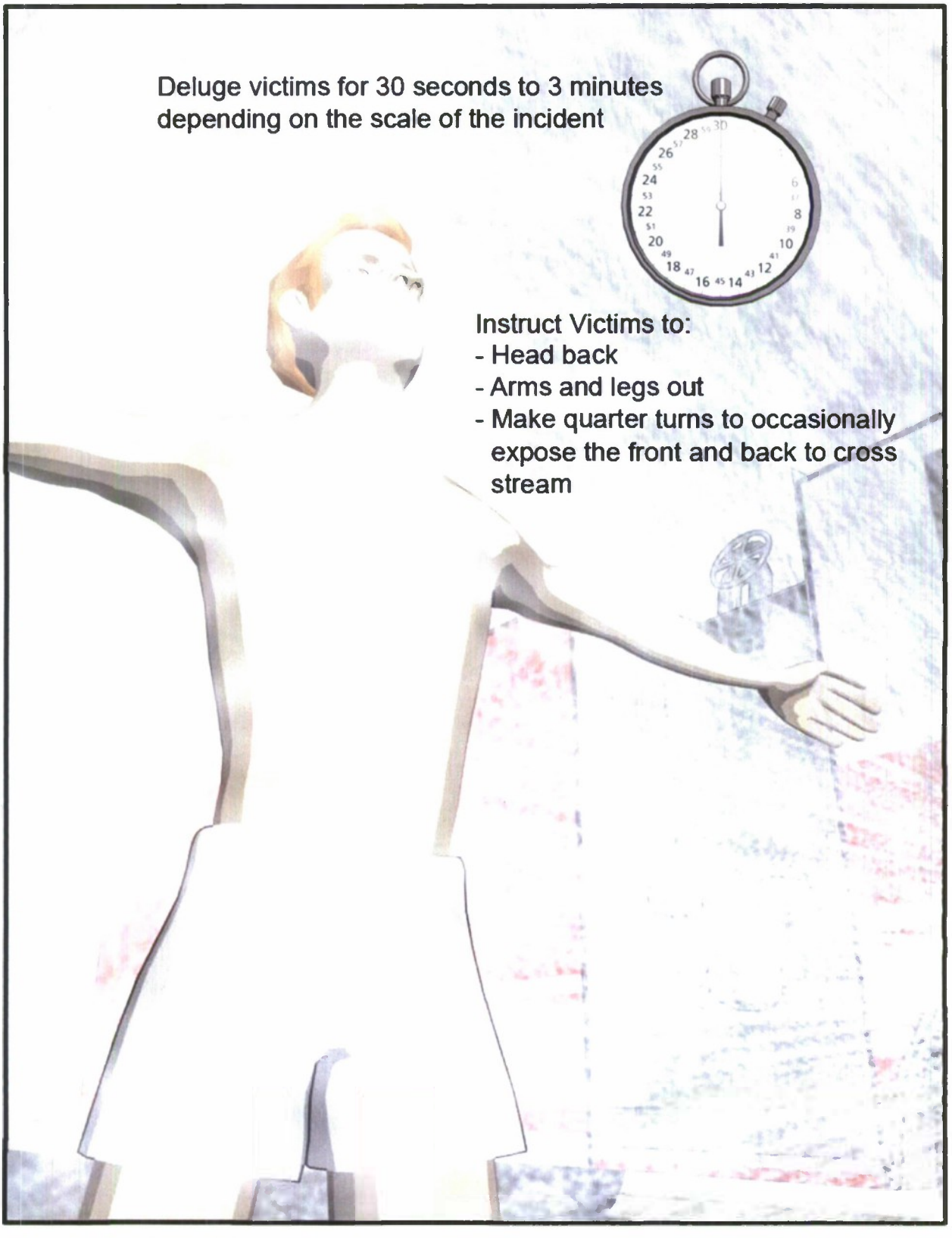

Figure E-9. Proper Mass Decontamination Shower Technique

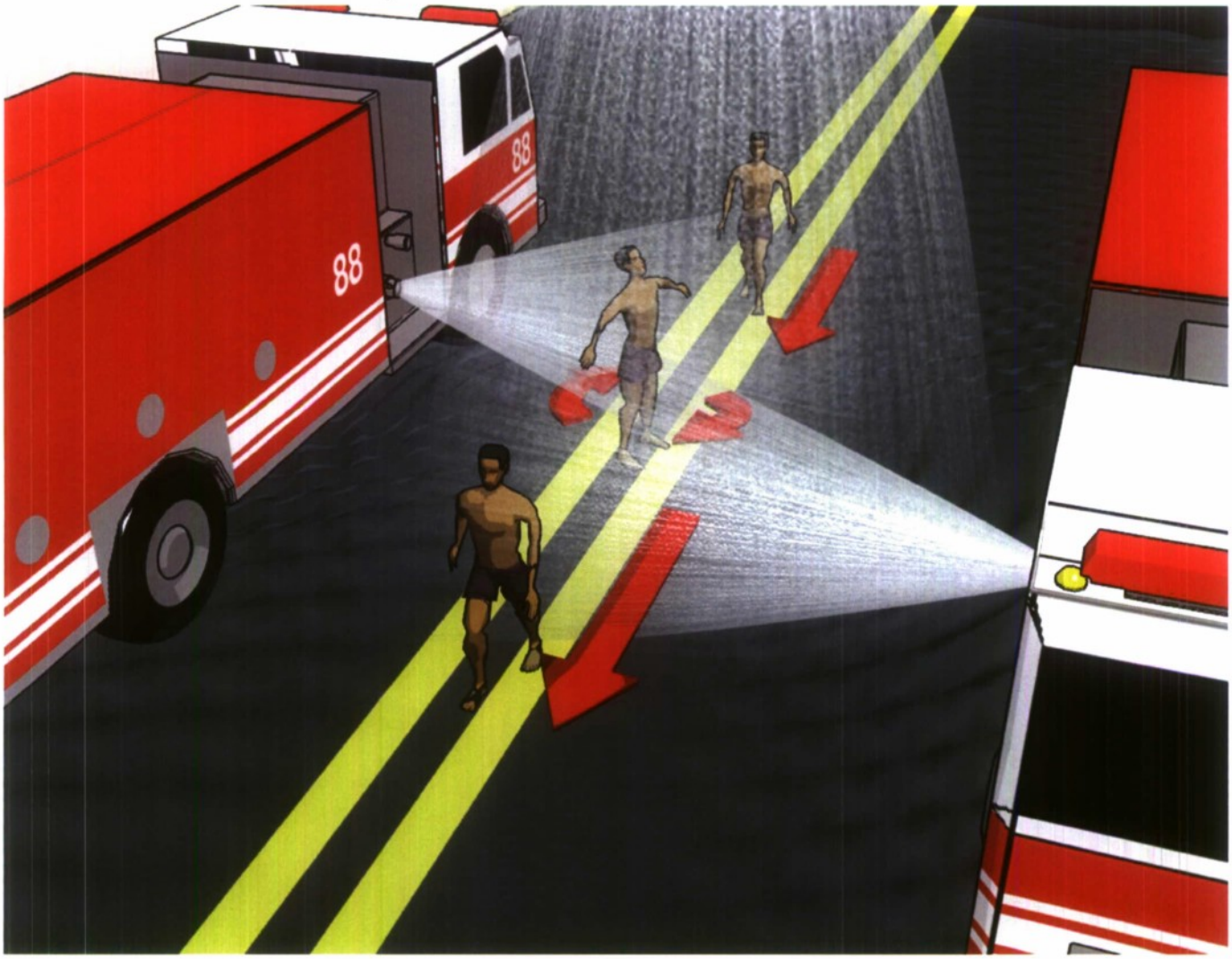

Figure E-10. Proper Decontamination Corridor Procedure

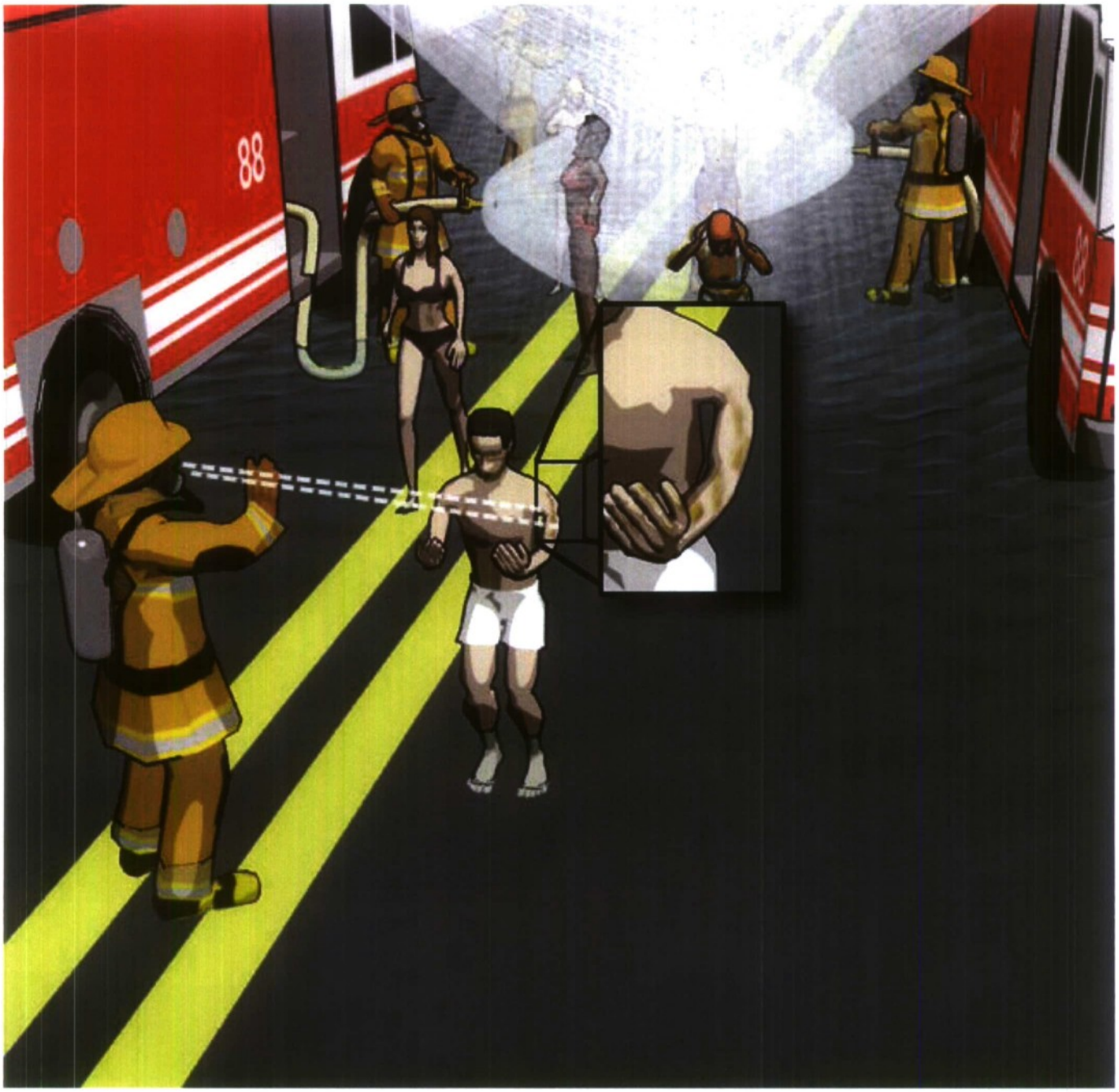

Figure E-11. Oily Agent Residue Following Decontamination

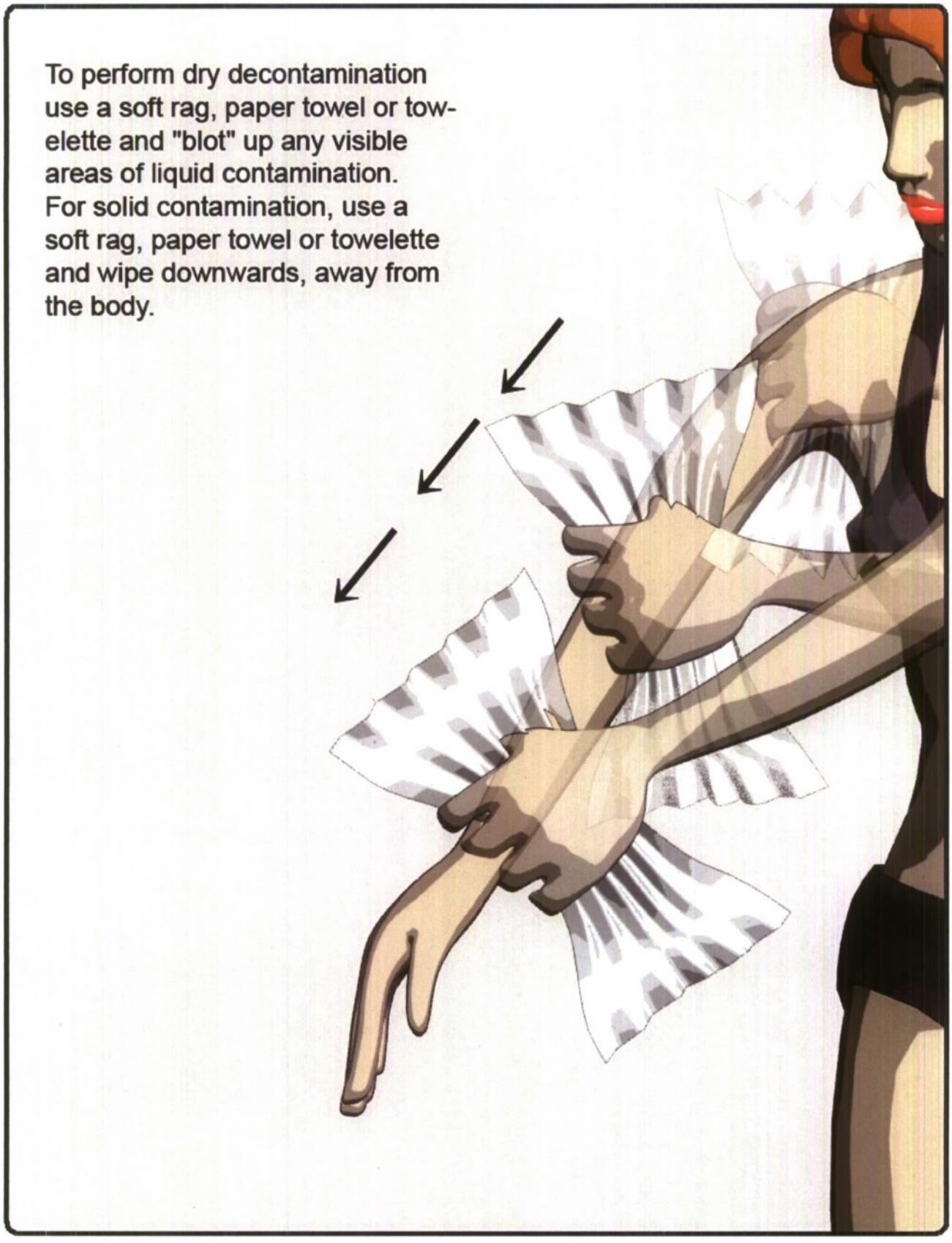

Figure E-12. Dry Decontamination Technique

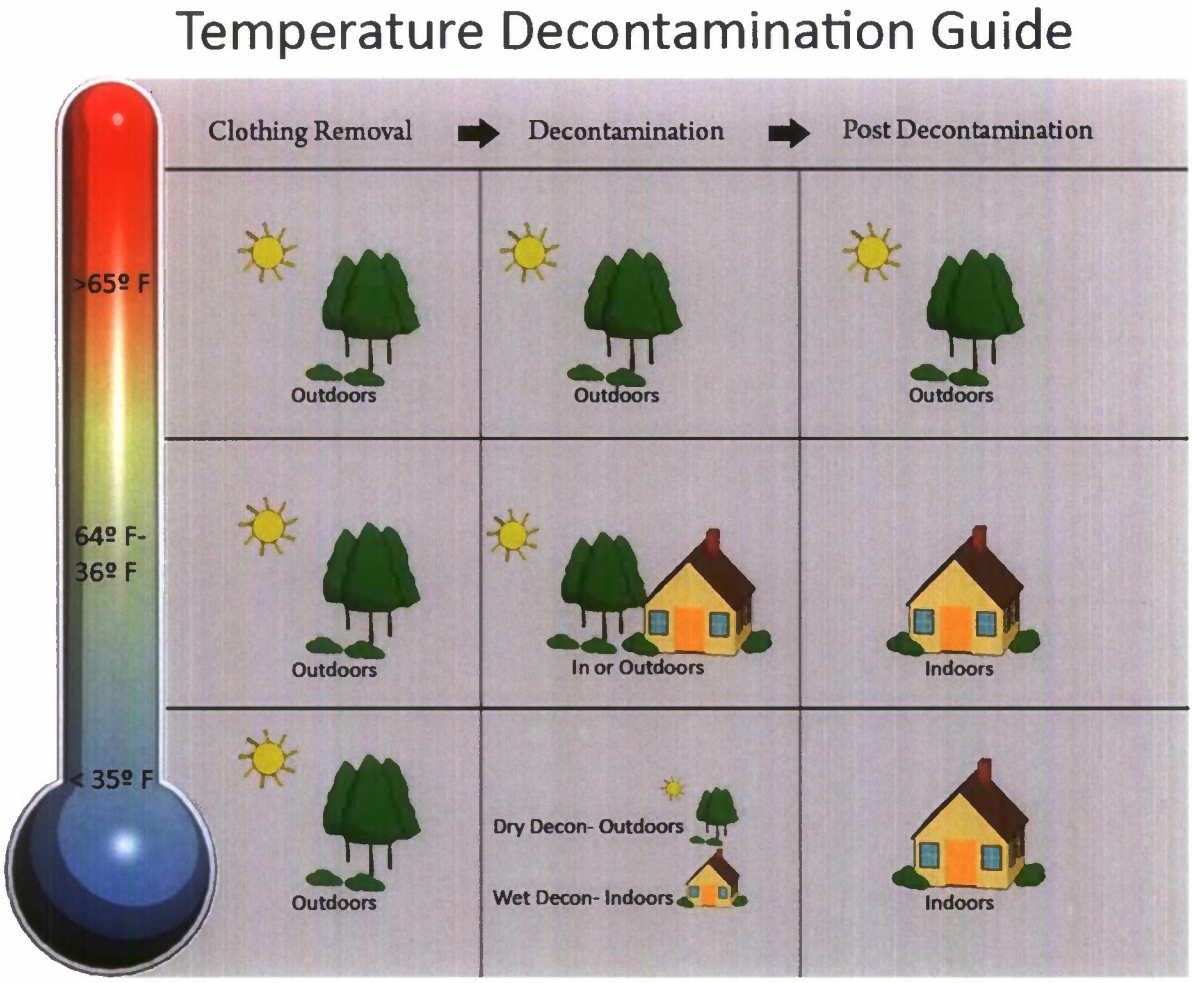

Figure E-13. Cold Weather Decontamination Guide

Appendix F: Volume I and II Development Process

These updated Mass Decontamination Guidelines were developed following a systematic approach that included research of existing materials related to mass decontamination, a Working Group comprised of scientific and response subject matter experts to identify the Guidelines' content and format, and a peer review of the Draft Guidelines.

1.0 Research

Thorough research was conducted on materials related to decontamination and best practices that have been developed since publication of the original Guidelines in 2000. Research included:

- Review of the Department of Homeland Security (DHS) Lessons Learned Information System (LLIS)
- Review of reference sources for the 2000 Mass Casualty Decontamination Guidelines
- Review of the Emergency Response Guide
- Review of National Incident Management System (NIMS) for terminology
- Review of medical databases to include PubMed Central and International Journal of Disaster Medicine
- Review of available exercise after action reports (AARs)
- General review of internet resources related to mass decontamination

Research for best practices for information on the following topics:

- Initial marshalling of victims
- Decontamination triage
- Rapid set-up with/without additives
- Handling/tracking of personal property
- Public education
- Operating in multilingual communities
- Observation, evaluation, screening
- Secondary decontamination

Results of Best Practices Research.

Initial research revealed very little in terms of best practices to include with the Guidelines. Review of AARs identified a few approaches communities were using, but no details on referenced methods or procedures. The AARs included references to the use of bull horns and signs for marshalling victims and the use of colored bands or special triage tags to identify decontaminated victims.

Research identified an article describing use of colored clothespins to tag victims and another that provided a more extensive and detailed approach to mass decontamination for a radiological incident. Both articles are included in this Guideline.

Research also identified several documents that reinforced the basic concepts contained both in this updated Guideline, as well as the original Guideline. Several documents identified during research referenced the original 2000 Guideline.

2.0 Peer Review

The draft updated Guidelines were posted on the DHS LLIS for peer review and to solicit additional potential best practices for inclusion in Volume II.

3.0 Working Group Actions

3.1 Working Group Sessions

The Working Group met on four occasions to discuss the approach for the updated Guidelines and determine the mass casualty decontamination methodologies and procedures; review recommended best practices for inclusion; review the draft Guidelines; and review comments received from the LLIS Peer Review.

All the Working Group sessions generated vigorous discussion and debate regarding the mass decontamination methodology and format for the updated Guidelines. Two areas that generated the most discussion were the methodology for liquid chemical contamination and cold weather decontamination.

3.2 Format for the Guidelines

The Working Group decided early on to develop the updated Guidelines in two volumes rather than a single document. The responder members of the Working Group felt that a short, concise volume that provided the basic mass decontamination methodology would serve the response community better than a single, large, detailed document. Supporting information, technical information and other reference materials were to be included in a second volume.

Responders also expressed a desire for more graphics to describe the methodology and procedures. Finally, responders expressed the need for the Guidelines to include checklists that could be removed and used during an actual mass decontamination operation.

3.3 Graphics

The Working Group elected to use picture graphics rather than photographs to provide a consistent style and format. The Working Group also hoped that the graphics could be used by responders during an actual decontamination operation both as guides for their own operations and to help provide instructions to victims.

4.0 Working Group Members

The following agencies provided representatives to serve as members of the Mass Decontamination Working Group.

These updated Guidelines could not have been completed without the significant collaborative efforts of the Mass Decontamination Working Group. Members of the Working Group include:

- Aberdeen Proving Ground Fire and Emergency Services, Aberdeen, Maryland
- Armed Forces Radiobiology Research Institute
- Baltimore County Fire Department, Baltimore County, Maryland
- Booz Allen Hamilton
- District of Columbia Fire and Emergency Medical Services, Washington, DC
- District of Columbia Homeland Security and Emergency Management Agency, Washington, DC
- Dr. Richard Hutchinson, Independent Consultant
- Hazardous Materials Response Team, Harford Country Division of Emergency Management, Harford County, MD
- Lebanon Fire District, Lebanon, New Hampshire
- Maryland State Police
- Montgomery County Fire and Rescue Services, Montgomery County, Maryland
- Mr. Harry Cusick, Independent Consultant
- New England Center for Emergency Preparedness, Dartmouth Medical School, Dartmouth-Hitchcock Medical Center, Dartmouth, New Hampshire
- Philadelphia Fire Department, Philadelphia, Pennsylvania
- U.S. Army Chemical Biological, Radiological and Nuclear School
- U.S. Army Edgewood Chemical Biological Center
- U.S. Army Medical Research Institute of Chemical Defense
- U.S. Army Medical Research Institute of Infectious Diseases
- U.S. Army Training and Doctrine Command
- Washington Hospital Center, Washington, DC

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Appendix H: Glossary

Ambulatory – Victims able to understand directions, talk, and walk unassisted.

Casualty – An inured person.

Cold Zone – Uncontaminated area of a HAZMAT incident site.

Deck gun – Aimable, controllable high-capacity water jet used for manual firefighting.

Decontamination Triage – Prioritization of victims for decontamination based on injury and evidence of contamination and/or exposure to the hazard.

Fog nozzle – Firefighting hose nozzle that separates water into droplets.

Hazardous Material (HAZMAT) – Any item or agent with potential to cause harm to humans and animals.

Hoseline – A thick, high-pressure hose used to carry water to a fire to extinguish it.

Hot Zone – Contaminated area of HAZMAT incident that must be isolated and requires suitable protective equipment to enter and decontamination upon exit.

Ladder pipe – Nozzle attached to aerial ladder and used to direct a heavy stream of water.

Mass Casualty – Any large number of casualties produced in a relatively short period of time, usually as the result of a single incident.

Mass Decontamination – Decontamination of large numbers of people, in the event of contamination by a harmful substance.

Neutralization – Counteraction of the effects of a hazardous substance.

Non-ambulatory – Victims who are unconscious, unresponsive, or unable to move without assistance.

Sarin – An extremely toxic nerve agent; also known as GB.

Toxic Industrial Chemical (TIC) – Chemical compounds used or produced in industrial processes that are toxic to humans.

Toxic Industrial Material (TIM) – Toxic radioactive compounds used or stored by industry.

Triage – Evaluation of exposed individuals based on type and seriousness of injury for the purpose of decontamination prioritization.

Warm Zone – Area where personnel, equipment decontamination, and hot zone support takes place.

Weapon of Mass Destruction (WMD) – Weapon or device that is intended, or has the capability, to cause death or serious bodily injury to a significant number of people.

Appendix I : Acronym List

AAR – After Action Report

ASAP – As soon as possible

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

CBR – Chemical, biological, radiological

CBRN – Chemical, biological, radiological, nuclear

CBRNE – Chemical, biological, radiological, nuclear, high-yield explosive

DHS – Department of Homeland Security

ECBC – Edgewood Chemical Biological Center

EMS – Emergency Medical Services

EPA – Environmental Protection Agency

HAZMAT – Hazardous material

LDS – Ladder-Pipe Decontamination System

LLIS – Lessons Learned Information System

MOA – Memorandum of Agreement

MOU – Memorandum of Understanding

NCP – National Contingency Plan

NFPA – National Fire Protection Association

NIMS – National Incident Management System

RSDL – Reactive Skin Decontamination Lotion

SCBA – Self-contained Breathing Apparatus

TIC – Toxic Industrial Chemical

TIM – Toxic Industrial Material

WMD – Weapon of Mass Destruction